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ABSTRACT

This guide was designed for developers of mastery learning materials for competency based learning situations. Topics include: (1) how mastery learning works and how the mastery learning process can be used in the classroom; (2) the advantages of mastery learning; (3) how to determine if mastery learning is right for student needs; (4) how to create the necessary support for the development project within an organization; (5) how to plan for a development project; (6) how to analyze the learning objectives of a unit, course, or program; (7) how to design and develop test blueprints, domain specifications, and items for criterion referenced tests; (8) how to determine test length, testing frequency, and related problems; (9) how to design and develop correlated remedial materials; (10) how to design and carry out pilot tests of mastery learning draft materials; and (11) how to revise drafts based on pilot test findings. Practical suggestions are included for authors, editors, artists, and others in the development process. (Authors/JD)

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MASTERY LEARNING

DEVELOPER'S GUIDE

How to Develop Tests and Teaching Materials For All Types of Mastery Learning Systems

Especially for teaching Consumer Education and basic competencies to teenagers and adults who are deficient or reluctant readers

Prepared by
The Mastery Learning Team
Laubach Literacy International
under a grant from
The U.S. Office of Consumer Education

January 1982
Syracuse, New York

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Finally, they join me in expressing thanks to officers in the U.S. Office of Consumer Education for their help and cooperation over the entire course of this project.

Steven Porter, Director
Mastery Learning Project
Syracuse, New York
January 21, 1982

PREFACE

Who should read this Guide

This Guide issues from our own year-long work in developing a mastery learning system in the money management area of bank checking for older teens and adult basic education students who read two or more years below grade level. Through trial and error, we developed a very effective, in some ways "ideal", mastery learning system that we are now publishing in kit form. We are practitioners, not researchers or academics, and we realize that there is no reason why other practitioners in various kinds of school systems and institutions cannot create their own mastery learning systems. We learned a lot in building our system and now we want to give you some "inside tips" and general suggestions to help you build your own systems, or just improve some of your own materials.

Our kit turned out to be a little more "ideal" than originally intended for the small subject area of bank checking. We created a lot of new teaching materials that go beyond the basics of mastery learning. We're glad now that we did, but it did require extra efforts and costs that you may not be willing to incur. Nevertheless, our experiences will still be highly relevant to your own case no matter how modest your plans are for developing materials or activities for reteaching students who do not pass this or that lesson's mastery test. It is essential to the concept of mastery learning that students have a chance to relearn material they could not master the first time around, so you will want to develop at least some reteaching materials to go along with the mastery tests you will develop. This Guide will give you all the information you need to develop whatever mastery tests and reteaching materials you have in mind.

Origins of this Guide

Laubach Literacy International (LLI) is a private, non-profit, educational agency whose mission is to enable literacy-deficient adults and teenagers the world over to learn basic skills. LLI supports volunteer-based tutoring programs in the U.S. and abroad. It also publishes teaching and learning materials not only for students and tutors in those programs but also for students and teachers in remedial and special education high school classes, in Adult Basic Education programs, and in other basic skills programs in a variety of institutions and agencies.

In the Summer of 1980, LLI applied to the Office of Consumer Education, U.S. Department of Education, for a grant-in-aid to develop and publish mastery learning materials in the consumer education area of money management, particularly bank checking. The grant was awarded and the project begun in October, 1980. One year later, the project produced, field-tested, and published a mastery learning kit entitled Mastering Checking.

This kit is close to being "ideal" because it includes three correlated student texts (readability: 3.5 grade level, Gunning):

- Understanding Checking (64 pages)
- Checking Illustrated (96 pages)
- Checking Practice (24 pages).

The kit also includes:

- Practice forms (sample blank checks, deposit slips, etc.).
- Answer keys (one set for teacher use, another for student self-correction).
- Teacher's Guide.

Teachers who use this kit are supposed to select either Understanding Checking or Checking Illustrated to act as the "Main Text" which their students will primarily learn from. Students take a mastery test at the end of each lesson. (The lessons in those two alternate Main Texts are correlated to each other and teach the same topics but use different teaching methodologies and approaches.) Students who do not pass a mastery test are called "non-masters"; they go to the correlated lesson in the "Alternate Text" to relearn the lesson's material. Masters go on to the next lesson in the Main Text.

The lesson non-masters study in the Alternate Text is correlated to the lesson in the Main Text which they didn't master. This correlated lesson reteaches the same content using a different approach. The Alternate Text is Checking Illustrated if the teacher selected Understanding Checking to act as the Main Text. The Alternate Text is Checking Practice if the teacher selected Checking Illustrated to act as the Main Text.

Retaught non-masters take a second mastery test at the end of the reteaching lesson. If they pass, they are genuine masters of the lesson and go back to the Main Text to start the next lesson. If they still did not pass this second mastery test, they get extra help from the teacher.

The chief innovations in our kit are that:

* Both Understanding Checking and Checking Illustrated can stand on their own and act as the Main Text, and
* Checking Illustrated can act either as the Main Text or as the Alternate Text and reteaching complement to Understanding Checking when the latter acts as the Main Text.

The reason why the kit is designed to provide two alternatives instead of just one is that Understanding Checking is a better Main Text for students who are not reluctant readers (but still read well below grade level) and who learn better when the text explains "why" as well as describes "how to". On the other hand, Checking Illustrated is a better Main Text for students who are reluctant readers and are more motivated by fewer words on the page and more illustrations and cartoons; this text stresses "how to" and explains things less thoroughly. Teachers can choose which of these two alternatives is better for their own classes.

The team which developed these materials field-tested them in seventeen classrooms in central New York State. Generally, the kit worked very well. The field test proved to us that adult and older teens who are "high risk" slower learners or are educable mentally handicapped students do strongly prefer mastery learning to other learning methods. However, their teachers had trouble using the kit both because it is a little more complicated than what they're used to, and because the kit itself takes on more of the responsibility for the primary teaching; the teacher manages the kit's use by students and provides individual help when students get in trouble -- and not all teachers appreciated this change in their roles in the classroom.

The team included professional practitioners, writers, editors, and test developers. But none in the team had any prior direct experience with mastery learning. We feel that other groups in the U.S. who are thinking about developing their own materials will appreciate reading about the lessons we ourselves have learned in our year-long development effort. Perhaps some of you will not only recognize how powerful mastery learning is but will also realize that it won't be that hard for you to develop your own mastery learning system. We have put together this Guide in hopes that you will be able to profit from our mistakes and emulate our achievements.

PREVIEW

This Guide is set up so you can either read it straight through as a continuous narrative or use it as a collection of separate and independent resource topics you can look up when you need to. For this latter purpose, rely on the detailed Table Of Contents to act as an index of resource sections.

PART ONE: What is Mastery Learning, and Why Is It Superior?

Highlights of how and why mastery learning works. Should give you enough for you to decide whether it would be worth your while to further explore the possibility of using mastery learning to improve the instructional prowess of your own curriculum.

PART TWO: Developing a Mastery Learning System: Key Decisions and Actions

Tells you how to create your own mastery learning materials. Describes a step-by-step procedure for planning and carrying out your development project based on our own experience in developing a mastery learning kit.*

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*In our project, we did develop mastery tests for the lessons in a text on bank checking which we had already published. But we also developed two new student texts, correlated to the lessons in that published text, which were much more thorough, detailed, and effective than the original published text.

At first, these two new texts were supposed to merely give students two alternative methods for relearning material in the original published text which they had not mastered. However, both of these alternative teaching methods turned out to be so vastly superior to the method used in the original published text that we decided to make the two new texts stand on their own and act as the core of our present kit (the original published text was dropped from the kit).

So, our project may have been more ambitious than what you have in mind for your own project. If so, don't worry - you will still be able to easily adapt our suggestions in this Guide to your own case. On the other hand, if you do start out with an initially more modest project, there is still the possibility that you might face the situation we found ourselves facing: whether to stick with your already existing teaching materials that you discover are very deficient or to develop new and vastly superior teaching materials. If this does happen, the Guide below will help you through your difficulties.

PART TWO (continued)

STAGE ONE: PRE-PLANNING DECISIONS

Checklist of things to consider when deciding whether you need and can afford to launch a mastery learning development project.

STAGE TWO: Planning and Preparation

Checklist of steps to take in planning, staffing, and financing the mastery learning development project, and in preparing your organization to buy into it.

STAGE THREE: Prepare Frameworks and Models

Checklist of steps to take in starting the project; further planning, working with target teachers, creating model tests and model teaching materials. How to develop mastery tests. Discussion of issues and details based on our experiences in this stage.

STAGE FOUR: First Drafts and Pilot-Test Preparations

Checklist of steps to take. Further discussion of how to write the teaching and reteaching materials. Instructional methods we used. Technical issues: graphics, formats, etc.

STAGE FIVE: Conduct the Pilot-Test of the First Draft

Checklist of steps to take. Nine points to keep in mind during the pilot test. Comments from our observation team leader. Issues to be checked out by observers of pilot test classrooms.

STAGE SIX: Revise the Pilot-tested First Draft

Checklist of steps to take. Brief account of some of the revisions we had to make in our first draft after we pilot tested and field tested it.

STAGES SEVEN-TEN: Field-Test, Final Revisions, Production, and Publication and Marketing of the Materials

These stages go beyond the scope of this Guide because they have nothing specifically to do with either mastery learning per se or development per se. They also require special technical expertise best provided by professional evaluators and publishers. Detailed descriptions of these stages have therefore been omitted.

PART ONE: WHAT IS MASTERY LEARNING, AND WHY IS IT SUPERIOR?

Basic mastery learning

Mastery learning is a special way of teaching that enables nearly all students to master what they study. Virtually all basic education curricula can be converted into mastery learning systems.

In mastery learning, a student works through a lesson and then takes a mastery test. If the student passes the mastery test, then he or she can go on to the next lesson. If the student doesn't pass the test, he or she gets a second chance and works through some remedial instruction on that lesson. Then the student takes a second mastery test on the same material. A passing score means the student is ready to go on. If the student fails to pass this second time, he or she gets a third chance and receives individualized help from the teacher in order to reach mastery.

That's really all there is to it. The point is that students don't tackle new lessons before they've mastered earlier lessons but they always get another chance to succeed.

What is ENHANCED mastery learning?

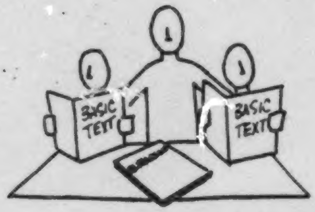
In basic mastery learning, the remedial or reteaching instruction that nonmasters work through can take the form of just restudying the same lesson. Or it may consist in the teacher working with the nonmaster or referring the nonmaster to other available and related materials.

In enhanced mastery learning, specially prepared reteaching materials have been developed in advance. They are specifically for reteaching the same content taught in the original main lesson. And they deliberately reteach that content in a different (usually simpler and more concrete) way. Enhanced mastery learning is better than basic mastery learning, but it is also more expensive and difficult to develop.

HOW DOES IT WORK?

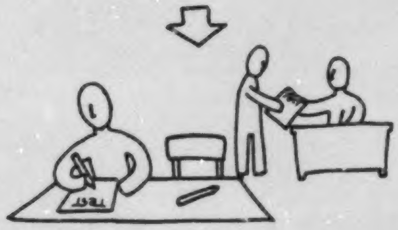
Independent Learning

All students work on their own through a lesson in the *Main Text:*



Mastery Testing

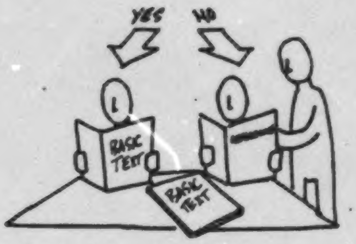
When he/she is ready, each student takes a Mastery Test on that lesson, teacher corrects and scores it:



New learning approach for Reteaching nonmasters

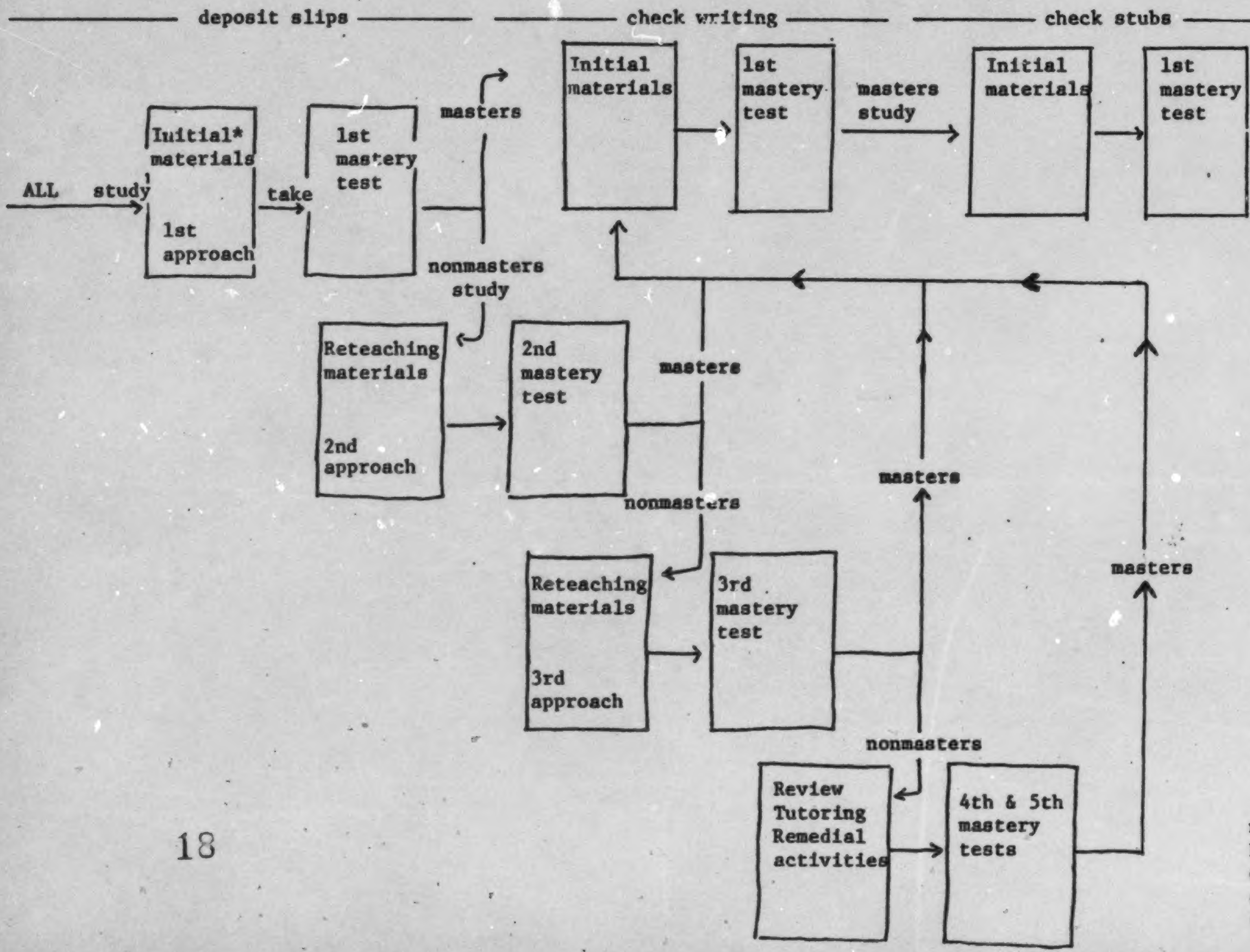
Masters go on to the next lesson in the Main Text.

Nonmasters go to the lesson's correlated reteaching lesson in the Reteaching Text, take a second Mastery Test. When they master the material, they go on to the next lesson in the Main Text.



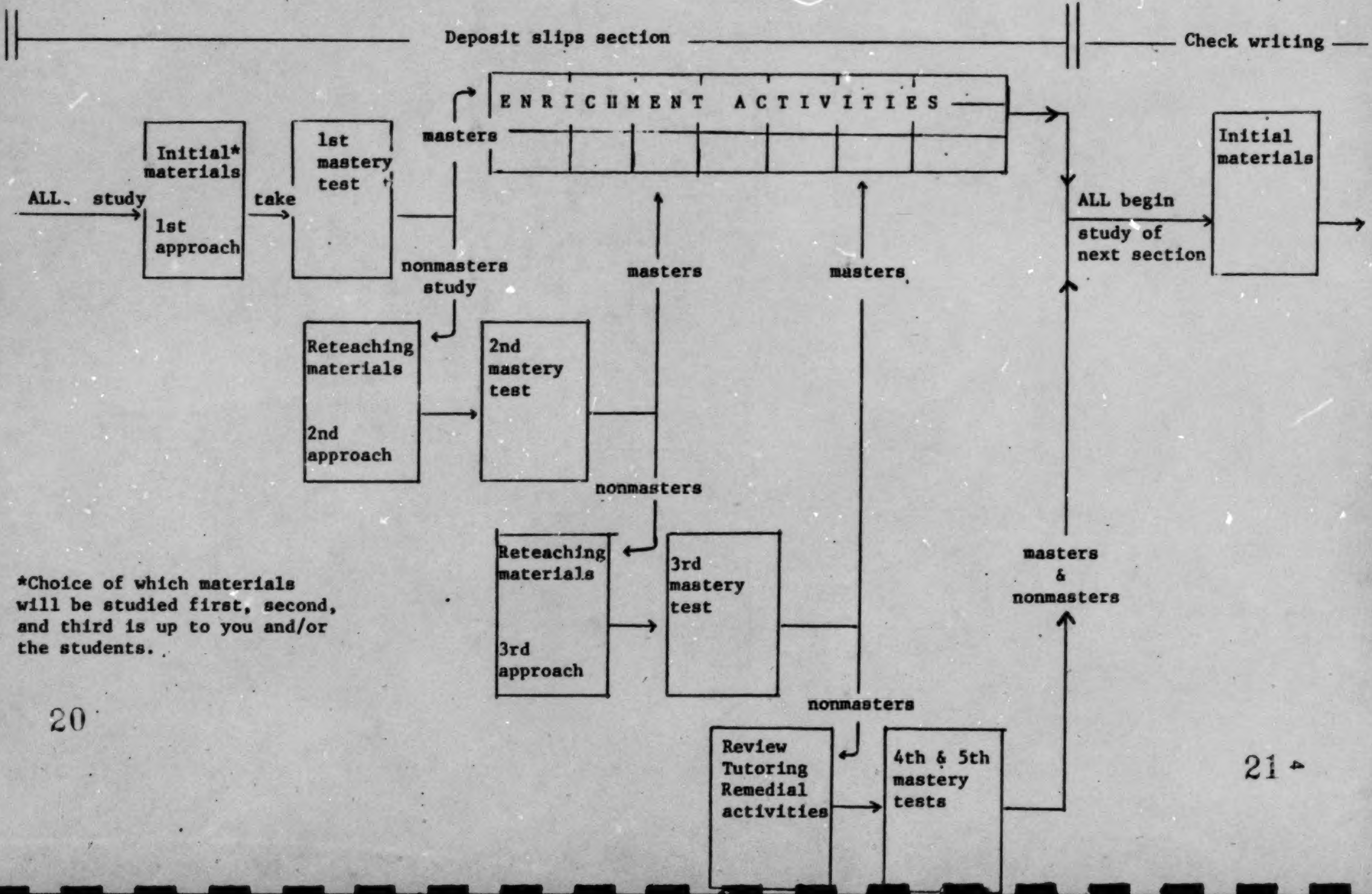
A more detailed picture of the enhanced mastery learning process that we use in our kit is displayed on the next two pages. Please refer back to these diagrams as you read through the rest of this guide.

For classes in which individuals go at their own pace, the process will look like this:


deposit slips
check writing
check stubs
ALL
study
Initial* materials
1st approach
take
1st mastery test
masters
nonmasters study
Initial materials
1st mastery test
masters study
Initial materials
1st mastery test
Reteaching materials
2nd approach
2nd mastery test
masters
nonmasters
Reteaching materials
3rd approach
3rd mastery test
masters
nonmasters
Review Tutoring Remedial activities
4th & 5th mastery tests
masters

nonmasters?
Decision:
Go to next section
or keep trying in
this section.

For classes that proceed together the process will look like this:


Deposit slips section
Check writing
ENRICHMENT ACTIVITIES
ALL study
Initial* materials
1st approach
take
1st mastery test
masters
nonmasters study
Reteaching materials
2nd approach
2nd mastery test
masters
nonmasters
Reteaching materials
3rd approach
3rd mastery test
masters
nonmasters
Review Tutoring Remedial activities
4th & 5th mastery tests
masters & nonmasters
ALL begin study of next section
Initial materials

*Choice of which materials will be studied first, second, and third is up to you and/or the students.

What does the research say?

A considerable amount of educational and psychological research has proven that

1. Frequent testing with immediate feedback and reteaching of unmastered material in early lessons tends to strengthen the desire to learn and build self-confidence.

2. Thorough learning (= mastery) of earlier material tends to facilitate and quicken the learning of later material; although sometimes slower and more time-consuming than conventional methods at the outset of a course, mastery learning is often less time-consuming in the long-run because later learning is faster.

In all mastery learning, nearly all students succeed

The basic assumption of mastery learning is that most students can master what is being taught. In the typical nonmastery classroom, only the best students are expected to achieve mastery.

In the usual American school, only those students who can achieve high scores in a certain amount of time are judged to be masters. The underlying assumption is that a "good" student is one who learns more quickly than others. Most of the psychological rewards go to the quick learners, and most of the psychological punishment goes to the slow ones.

Mastery learning asks, "Does it really matter how long it takes a student to learn something? If a student does take a little longer to learn, but still learns, why not give that student full credit for learning?"

In mastery learning, a much higher premium is put on degree of learning than on rate of learning. So most students can master each lesson as it comes. This is possible because each student is given the time he or she personally needs in order to learn.

Learning isn't threatening or painful in mastery learning. Students know they can learn and know how to learn. Several studies have shown evidence of increased student achievement in mastery situations. When students realize that they can learn, through reteaching materials and retesting if need be, they usually decide they want to learn, and put more effort into learning.

It's important for students to feel they have some control over their learning. Many adult low level readers, especially, have bad feelings about learning due to past coercion and punishment in school. Mastery learning allows the student to learn at his or her own pace. And instead of the teacher always being the one with the questions, students also ask questions and take responsibility for their own progress.

Finally, mastery learning benefits the whole class because students often learn together, not as a collection of competing individuals. In mastery learning, students compete against themselves for mastery, not against each other for grades. Students cooperate and help each other because they no longer fear that they will lose special advantages over their classmates in the competition for grades.

The teacher's role

In the traditional classroom, the teacher is primarily a lecturer. In the mastery classroom, the teacher's role is more that of a consultant.

Under mastery learning, the teacher:

1. Introduces students to what is to be learned, explains a few things about mastery learning, and explains how to use the materials.

2. Answers students' questions and helps them when they need help. Usually, the teacher helps students individually. But sometimes, several students will be at about the same place in the materials and will be having the same problems. Then the teacher will want to group these students and teach them all together (for that one particular problem). If there is something which most students have had trouble with, the teacher may want to give an explanation tothe whole class at once.

3. Always has the option of supplementing the mastery materials with various other activities. Some of these might be doing extra worksheets, reading extra review material, class discussions, role-playing, class trips, and so on.

4. Administers the materials at a rate suitable to each student.

5. Helps students keep track of their progress.

6. Praises, encourages, motivates.

7. Lectures and demonstrates when most students have mastered a particular section. The teacher doesn't give tests on the content of these lectures and demonstrations. Their only purpose is to motivate students and stimulate learning.

One big advantage of mastery learning is that teachers have the opportunity to give students individualized attention.

Some teachers have very strong preferences for teaching their class as a whole. In mastery learning, that can work like this:

a. The teacher has the whole class study a unit together.

b. Then each student takes a test on that unit.

c. Students who don't pass the unit study reteaching materials, then take a second mastery test.

d. Students who do pass the unit either tutor the others, do free reading, do reading or other activities related to the topic of study, do work for other courses, or work on a personal project.

e. When all or nearly all students have passed the mastery test, the class goes on to the next unit.

In general, we feel that it's better to allow each student to move ahead at his or her own pace. Most students, once they've passed a mastery test, don't like being held back. Still, the "whole-class" system is a viable option.

Mastery tests

Mastery tests are "criterion-referenced" tests. They refer or compare student performance to a standard or criterion of proficiency in a given skill or knowledge area. If a student's score surpasses the cut-off "mastery" level on that criterion, then the student is said to have "mastered" that skill or knowledge area.

This is significantly different from achievement or "norm-referenced" testing. Here the student's performance is not compared to an absolute standard or criterion of proficiency. Instead, the student's performance is referred or compared to the performances of fellow students or to the normal curve distribution of performances of students of the same age or grade level across the U. S.

In mastery learning, students take a mastery test after studying each unit. These tests are for the purpose of guidance, not grading. They tell the student if he or she knows the material, or if extra study is needed. Also, wrong answers on specific test items indicate specific deficiencies.

Mastery tests should test for different types of knowledge. An overemphasis on one type, say "definitions", could lead students to not develop other types of thinking skills. It's a good idea, even before developing the first test, to list the types of skills to be included in the tests. These should be skills which you know the particular users of the materials have the capacity to learn.

Mastery tests can give a school, and employers outside a school, a good idea of what a student actually has learned. When a student demonstrates mastery of a course, mastery becomes a legitimate form of certification. Grades based on class rank, on the other hand, are difficult to interpret.

Testing and grades

Limiting the length of time for learning a given unit of material keeps slow students from learning thoroughly. In a sense, it discriminates against the slow student. The discrimination is even greater if slow learners are consistently given low grades. These low grades label slow learners as inferior. And this labeling generally has a negative effect on the students' attitudes toward themselves.

There are other serious problems with the traditional grading system. For one thing, grades have no meaning across classes or across schools. Grades just rank students within a class. So an A student in one school could, with the same performance, conceivably be an F student in another school.

Another problem is that student's grades depend on how other students in the class do. So if a student's performance improves, but other students' performances also improve, the student's grade stays the same.

In mastery learning, testing and grades are handled differently. Mastery tests compare the student's current performance with his or her own prior performance. The tests don't give the student negative messages about how he or she is doing compared to other students.

In mastery learning, the number of rewards isn't limited. As long as a student learns to the level expected, he or she is given credit for succeeding. One can compare fast and slow students to motocycles and bicycles. One may be faster than the other, but they can both get there.

Performance standards

There aren't any hard and fast rules for judging mastery. It really depends on the curriculum writers', teachers', and administrators' perceptions of what would constitute mastery in each instance. Difficulty level will vary a bit from unit to unit and test to test. So for one unit, an 80% level of correct or appropriate responses might be sufficient, for another - 90%, for another - 70%.

Reteaching materials

When students don't reach the mastery level on a test, they are given "reteaching" materials to bring them up to mastery level. Reteaching materials teach the same material as the original instruction, but from a different perspective.

The simplest reteaching is the help a student can get from a tutor, small group discussion, or the teacher. For your materials, there are many options. Among them:

1. an alternative textbook (deliberately designed to correlate and complement the Main Text in "enhanced" mastery learning)
2. drill sheets
3. a consumable workbook
4. audio-visual materials
5. flashcards
6. games and puzzles
7. activity cards
8. a combination of the above

In general, reteaching materials don't seem to work well when there are too many items to keep track of. Above all, the reteaching materials should be manageable. Teacher-consultants can be useful here in helping you judge what will easily work in actual classrooms.

Other advantages of mastery learning

Problems mastery learning can solve:

1. Frequently absent students cannot keep up with the class.

With mastery learning, a student resumes learning where he or she last left off. Students don't have to feel embarrassed or lost when they come back from an absence. And because mastery learning is less painful, normally poor attenders may not be averse to coming to school.

2. Some students have had numerous failure experiences. They may have just given up and no longer try.

With mastery learning, students start passing checkups from the first day on. It doesn't take them long to realize that their efforts bring success. In our field tests, we observed many "poor" students trying hard and succeeding. Students who'd never done well before started getting perfect scores (granted, perfection did not always come until their third mastery test for a unit, but perfection is perfection).

A friend who tried mastery learning, a teacher, told us this story. A black girl in his ninth grade class had never gotten higher than a C in a class. She'd tried to learn, but she was always behind. She tried especially hard in his mastery class. The last day of class, she came up to him and asked if she'd finally earned a B. He told her no. She just sighed and said "oh". Then he said, "You got an A." The girl's face quivered and then she broke down crying. The A gave her an image of herself she'd never even dreamed of before.

3. Many students daydream or misbehave while the teacher lectures. These students are used to being active people, and they don't like the passive role.

In mastery learning, students are always busy. They're always responding. Not only that, there's less of a feeling of always taking orders from the teacher. If the student gets tired of studying the mastery materials, he or she can take a short break. Other times, when the student feels like speeding along with the materials, that's possible too. (And don't believe that won't happen. This comment, from a student in our field test who was busy at work, might give you an idea: "Hey, don't let that bell ring. I'm really hot now!")

4. With classes of adult low level readers, there's usually a wide variation in reading ability among students.

This doesn't cause a problem with mastery learning. The materials can accommodate a wide range of abilities. Also, with individualization, students can learn at whatever speed is most comfortable.

5. Each of these learners has unique learning problems. In traditional instruction, if a teacher takes much time helping one student, the class stops and the others have to wait.

In the mastery system, learning isn't so dependent on the teacher. If the teacher takes time to work with one student, the other students can keep learning on their own with the materials.

6. Many of these students have bad learning habits. They don't make a second effort if they fail to understand, they read without trying to comprehend, they don't read anything unless the teacher tells them to.

Mastery learning teaches students how to figure things out. And it teaches them that they don't always need the teacher in order to learn.

7. Few publishers put out good materials for this audience.

With mastery learning, you can adjust existing textbooks (by writing reteaching materials and mastery tests) so that they fit the needs of your students.

A Day in a Typical Mastery Learning Class on Bank Checking

It would take hundreds of pages to describe, in detail, how actual enhanced mastery learning courses have worked. But we would like to at least give you a taste of what it's like to teach such a course.

For this example we assume a very small class (to keep this from becoming too confusing for the reader) of four students: Mike, Betty, Sandra, and Carlos. Read the description on the left, then look at the right-hand column which gives you an idea of how the teacher moves around through the materials.

Description	Teacher Preparation Faction
The teacher, Ms. Wallen, is now ready to have her class begin lesson 3. She begins her class with a lecture. This lecture describes briefly the topics to be covered in Lesson 3.	She studies the teacher's Guide and the contents of Lesson 3.
The first topic in Lesson 3 is Deposit Slips. Sandra is the student who's been moving most quickly through the materials. But lately Carlos has been learning quickly too. Ms. Wallen decides to start these two off in the green book.* Betty seems to have been doing well in the blue* material lately, so Betty will begin in the blue.	Looks at the descriptions of the enrichment, main and reteaching texts in the Teacher's Guide. She looks at her map of student progress. Using this map, Ms. Wallen determines that Sandra and Carlos should work in the Main Text, page 17, Betty in the enhancement text, pages 20-21, and Mike in the reteaching text, pages 7-9. Note: the information about each student appears on that student's Progress Sheets,

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*For simplicity, we'll say that: "the blue book" = "the Enrichment Text"
"the green book" = "the Main Text"
"the yellow book" = "the Reteaching Text."

Mike has had some problems with both the blue and the green materials, so Ms. Wallen decides to start him off in the yellow.	in his/her folder. So students can quickly see where they should be.
Sandra finishes first. She asks Ms. Wallen for a check-up. Ms. Wallen checks her exercise on deposit slips in the green book, asks her an informal question about deposit slips, then hands her a check-up (mastery test).	Ms. Wallen uses her answer key to check Sandra's work, and turns to her Deposit Slip check-ups. Ms. Wallen decides to give Sandra check-up #001.
Now Carlos has finished. Carlos still doesn't quite understand the word "endorse." He asks Ms. Wallen about it and she explains. Then she gives Carlos a Deposit Slip check-up.	She gives Carlos Deposit Slip check-up #002. (She doesn't want him to have the same test as Sandra.) Note: for each lesson, the teacher has four or more alternate but equivalent Mastery tests, or different versions of the same test.
Betty says, "Hey, Ms. Wallen, I've finished page 21." Ms. Wallen says, "Okay, hang on a second. I'm almost done helping Carlos." Then she comes over. Ms. Wallen Checks Betty's exercises in the blue. Betty missed the first question. Ms. Wallen asks her about it. It turns out to be just a minor confusion. Now Betty understands. So Ms. Wallen decides to give her a check-up.	Ms. Wallen looks up answers in the blue answer key, then gives Betty Deposit Slip check-up #003.
Sandra asks Ms. Wallen to score her check-up ("Deposit Slips check-up #001).	Ms. Wallen turns to the Deposit Slips #001 Score Key.
Ms. Wallen finds that Sandra has made no mistakes. She asks Sandra a few off-the-cuff questions and finds out that Sandra really seems to understand deposit slips quite well. She winks at Sandra and says, "Hey, nice goin', kid." Then she gives her a new assignment.	Looking at the bottom of the Deposit Slip #001 score key, Ms. Wallen decides to assign green pages 18, 37-42. She circles those pages under the green column in Sandra's progress sheet.

Mike wants Ms. Wallen to check his exercises. She does, and she finds that Mike has made several mistakes. She discusses the correct answers with him. Then she gives him a check-up.	Ms. Wallen looks up the answers to the exercises in Checking Illustrated (the yellow material). Then Ms. Wallen gives him Deposit Slip check-up #004.
Ms. Wallen checks Carlos' check-up. Carlos got both the cash amount and total amount wrong. They chat a moment about the problem, then Ms. Wallen says, "I think the blue materials would be a help here, Carlos." Then she assigns him some "enriched" reteaching in the blue materials.	Ms. Wallen turns to Deposit Slip score key #002. Using the map at the bottom, Ms. Wallen assigns Carlos pages 20-21 in the blue materials. She circles these pages in his progress sheet.
Betty also makes several mistakes on her check-up. Ms. Wallen assigns her reteaching in the yellow materials.	Using Deposit Slip score key #003, Ms. Wallen assigns yellow pages 7-9b.
Sandra needs a new check-up.	Ms. Wallen gives her the Check-writing check-up #001.
Ms. Wallen checks Carlos' exercise answers in the blue materials. He got all answers correct. She then gives him a check-up.	Ms. Wallen turns to the exercise answers for Understanding Checking (the blue material). Ms. Wallen gives Carlos Deposit Slip check-up #001.
Ms. Wallen checks Mike's check-up. He's still making several mistakes. She assigns him some reading on deposit slips in the blue material.	Ms. Wallen uses Deposit Slips score key #004. She assigns Mike blue pages 20-21.
Let's skip ahead a little. Carlos has now mastered the unit on deposit slips, whereas Mike still isn't clear on a few things. Ms. Wallen asks Carlos if he'll help Mike understand deposit slips. Carlos agrees.	Mike is in blue pages 20-21.
Both Sandra and Betty have now mastered deposit slips. (Actually, Sandra is already well on her way to mastering check-writing.) Ms. Wallen suggests	Ms. Wallen is using activity #1 under remedial activities, and #2 under enrichment activities in the Teacher's guide.

the two of them role play opening a checking account. She also suggests they fill out deposit slips, depositing ten checks	
Mike takes a second check-up on deposit slips, and passes this time.	Ms. Wallen gives him Deposit Slip check-up #002.
Carlos asks Ms. Wallen if he could try the yellow materials for the check writing section. He likes the cartoons. Betty wants to try the green for a change. She says, "You learn faster in the green." Sandra wants to try the blue. She finds it more interesting than the green. Ms. Wallen agrees to all of these requests.	Ms. Wallen uses the students' progress sheet to show them what pages to study in the books they've selected.

This should begin to give you a feeling for how the system works (at least under this particular management strategy).

One important difference from usual classroom methods is that teachers do little lecturing. The teacher is a manager of the instruction. The materials shoulder the primary burden for the instructing. The teacher administers, helps special individual problems, and fills in the gaps where the materials fall short.

Most of the teacher's teaching in mastery learning comes at three points: 1) when students ask questions or look confused, 2) when the teacher corrects answers on the materials and check-ups -- and the particular student needs explanations for items he or she missed, and 3) when the teacher feels the time is right for additional teacher-directed activities.

It is our experience that the first few days with the kit are by far the hardest for the teacher and the class. It takes a little while to get the class into the swing of things. But once everyone gets used to the system, you'll be pleasantly surprised at how smoothly the learning goes -- and by how well-motivated your students become.

PART TWO: DEVELOPING A MASTERY LEARNING SYSTEM: KEY DECISIONS AND ACTIONS

STAGE ONE: PRE-PLANNING DECISIONS

Assumption: you are ready to consider the wisdom of building a mastery learning system.

I. Do you really need a mastery learning system?

A. Do the materials in your instructional system really need to be improved, or can your resources be better spent on improving the teaching, organization, or student-support in your system?

B. If you do need better materials, should they do the following for your most-in-need students?

1. Offer them the opportunity of a second, or even a third, chance to restudy, relearn, and be retested on a lesson until they achieve mastery?

2. Test them in order to decide whether they have mastered the current lesson and are ready to go on to the next lesson?

3. Test them on whether they have mastered the material, and not on how they compare to fellow students or to a national sample of students of the same age or grade level?

4. Enable them to work and learn by themselves with a minimum of help from their teachers?

5. Enable them to learn and move through the materials at their own pace regardless of how fast the rest of the class is moving?

If you answered "yes" to all of the above questions, then you may need to build a mastery learning system for your most-in-need students. (Even if you answered "no" to #4 or #5, you may still need to build a modified version of such a system.)

II. Can you afford to build a mastery learning system?

A. Will your teachers accept mastery learning or too strongly resist it?

B. Will key administrators endorse building the system and, later, encourage teachers to accept and use it?

C. To what extent will your current materials need to be revised, and/or new materials and tests need to be developed? At what cost?*

D. How thoroughly will you need to field-test the reliability and validity of the tests? At what cost?*

E. Can gaps in your staff's expertise be filled by available and qualified outside experts? At what cost?*

F. How much will C.-E. Cost? Will the expected benefit from a new mastery learning system be greater than this cost?

G. Will the needed funds and staff time in fact be available in the amounts required during the development period?

If you answered "yes" to both F and G., then your organization should build a mastery learning system unless another strategy will produce even greater benefits at the same or lower cost level.

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*All you can do at this stage is make "ball park" estimates of these costs. Read this entire Guide before attempting to estimate development costs.

STAGE TWO: PLANNING AND PREPARATION

Assumption: you are virtually convinced that you should and can build a mastery learning system.

A. Recruit a director for the development project who will champion, manage, and commit to it.

B. Determine whether your most-in-need students need their learning materials to be (listed roughly in order of increasingly ambitious improvements to be undertaken):

1. Supplemented with mastery tests for each unit or lesson.
2. Supplemented with more exercises and practices.
3. Supplemented with additional instruction to fill in gaps in the current instruction.
4. Revised by being up-dated and made more relevant and interesting.
5. Revised by breaking down the instruction into smaller steps or units that teach underlying skills and subskills.
6. Revised by being rewritten using simpler vocabulary/constructions.
7. Supplemented with a full-blown alternate text that could teach the whole subject by itself but teaches or reteaches the subject in a very different way.
8. Replaced by completely new materials using an entirely different instructional approach.
9. Combinations of #1-8.

(NOTE: throughout the rest of this Guide, we will assume that you need a combination of improvements #1 - #7.)

C. Based on this needs assessment, describe the size, scope, and nature of the products to be developed in the project.

D. Based on this description, determine what steps and processes must be undertaken to develop those products; determine staffing requirements.

E. Specify the degrees of reliability and validity which the tests must be proven to have; if these require a field-test, estimate its cost.

F. Determine the actual availability and cost of outside consultants and services to backstop or fill gaps in expertise (e.g., expert test developer, evaluator, outside printer, artists, etc.).

G. Refine the Step One estimate of funds, staff, outside consultants, and time needed to carry out the development project. Re-evaluate the benefit-cost ratio. If the project no longer appears to be cost-beneficial, abandon this effort. Otherwise:

  1. Recruit and organize the development team (instructional developers, writers, test developers, (evaluator if field-test needed), administrators, and support staff).

  2. Invite and obtain commitments to the project from those in the environment whose acceptance will influence whether the project will be a success within your organization.

  3. Establish guidelines about the process for making management decisions, materials-development decisions, and test-development decisions.

  4. Get commitments-to-cooperate from those teachers who you will want to try out early drafts of the materials and/or tests.

5. Develop a calendar of development milestones or deadlines by which time each phase of the project should be completed.
6. Obtain formal commitments of funds and staff needed to launch.

APPENDIX

Initial contacts with teachers and students

When you're sounding out interested teachers who might be willing to participate in the pilot-test, you should if possible:

- Observe teachers and students at potential sites
- Take note of reading abilities, study skills, materials preferences of students
- Take note of how teachers manage their classes as well as what materials they prefer and how they like to present a subject.

Such observations could tell you if certain sites would not be appropriate for the kind of materials you are considering developing. For example, in our project if we had observed the two English for Speakers of Other Languages programs in Syracuse before we pilot-tested materials in them, we would have realized that our materials were inappropriate for them. The poor match was painful both for those teachers and students and for us during the pilot-test.

Qualifications of key members of the development team

Director:

- Able to act as team builder with staff that has diverse abilities. Helps each team member to see the value of the others, to learn to depend on the others, and to enhance the work of the others, without straying beyond their sphere of greatest usefulness.
- Able to win cooperation of administrators and teachers at pilot (and field) test sites, i.e., clearly ex-

plains nature and scope of testing program and its usefulness to the students and teachers involved.

- Able to keep sponsors informed about project's progress.
- Able to map out tasks to be accomplished, by whom, and by when, in order to reach projects objectives.
- Able to project costs of all activities.
- Able to monitor each activity of the project to make sure that agreed-upon quality and quantity are delivered by agreed-upon deadlines.

Materials Developer:

- Is aware of contemporary theories of instructional design, knows which would be appropriate for the target audience and can employ appropriate design models in writing the materials.
- Able to write at the reading level of the audience.
- Knows the subject area.
- Has experience in teaching the target audience or in observing such teaching.
- Writes concisely, simply, concretely, and interestingly.

Test Developer:*

- Has background in instructional design and test and measurement for task analysis and the writing of learning objectives.

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*This is the most critical position in regard to schedule and quantity of final product. Make absolutely sure you enlist someone who knows what he/she is doing, is highly productive, and can meet deadlines. A slow test developer will slow down or wreck your whole project.

- Has practical experience in developing test items of a variety of types and can present a portfolio of past work.

- Understands the difference between norm-referenced and criterion-referenced tests and can demonstrate competence regarding key issues such as deciding test length, test frequency, test format, teacher administration and scoring of tests, etc.

- Has statistical background and experience in item analysis, item discrimination assessment, reliability assessment, and validity assessment for both criterion and norm referenced test development.

- Can collaborate with others and share power and responsibility in a teamwork environment.

- Has experience in designing and conducting pilot tests of instructional materials (observing students, interviewing teachers, etc.).

Editor:

- All the above qualities of the materials developer (except that the editor need not be quite as knowledgeable as the author about the subject area).

- Able to catch inconsistencies in content, word usage and matters relating to particular style of presentation adopted by publisher, e.g., rules on when to italicize, use bold face, underline, capitalize, use parentheses, use hyphens, etc.

- Able to use readability formulas and re-write materials without sacrificing the human interest and accuracy while making it easier to read.

- Able to visualize final page -- where illustrations will go, how they'll be integrated with text, how wide the column width should be for text, how large illustrations will be, etc.

- Able to communicate this vision to artist/layout-designer.

- Able to suggest content of illustrations in way that inspires artist to find precisely the illustration that communicates the idea to be taught.

- Able to direct the artist toward desired design without stifling the artist's creativity.

Artist:

- Has experience directly or indirectly with target students in some learning situation, and is sensitive to their tastes, values, or ethnic composition so that her art expresses knowledge and appreciation of their culture.

- Knows the kinds of illustrations target students (in general) appreciate across a range, e.g. stylistic cartoons, photos, simple diagrams, but no straight line drawings, complicated diagrams (editor may have to communicate this to the artist).

- Respectfully portrays representatives of the target student population including differences in age, sex, ethnicity.

- Able to grasp the idea which the editor wants illustrated and can elucidate it.

- Willing to put learner's needs for clarity and simplicity above artist's desire for cleverness.

Consultants and the State-Of-The-Art

Consultants provide invaluable help in the development of mastery learning kits. You may need consultants who are expert in--

1. The subject you're presenting
2. The development of mastery tests
3. The development of teaching materials

By reading the latest journals and books in the area of instructional design, you'll find names of those who are prominent in designing instructional materials and criterion-referenced or domain-referenced tests. Contact the ones who seem to be doing the kind of work you want to have done. Seek out the very best ones first. Their price tag may be too high. If so, you can ask them if they know of others who could do the work. Try to find someone close at hand, for instance at a near-by university if there's one in your vicinity.

Do not contact anyone until you have familiarized yourself with the literature and the "state-of-the-art." Consultants work for you. They cannot lead, direct, or make decisions for you. They are most comfortable and effective when they are handed a well-defined statement of the scope of work they are expected to perform. You cannot formulate such a statement if you are ignorant of the state-of-the-art in the less technical aspects of mastery learning and criterion-referenced testing.

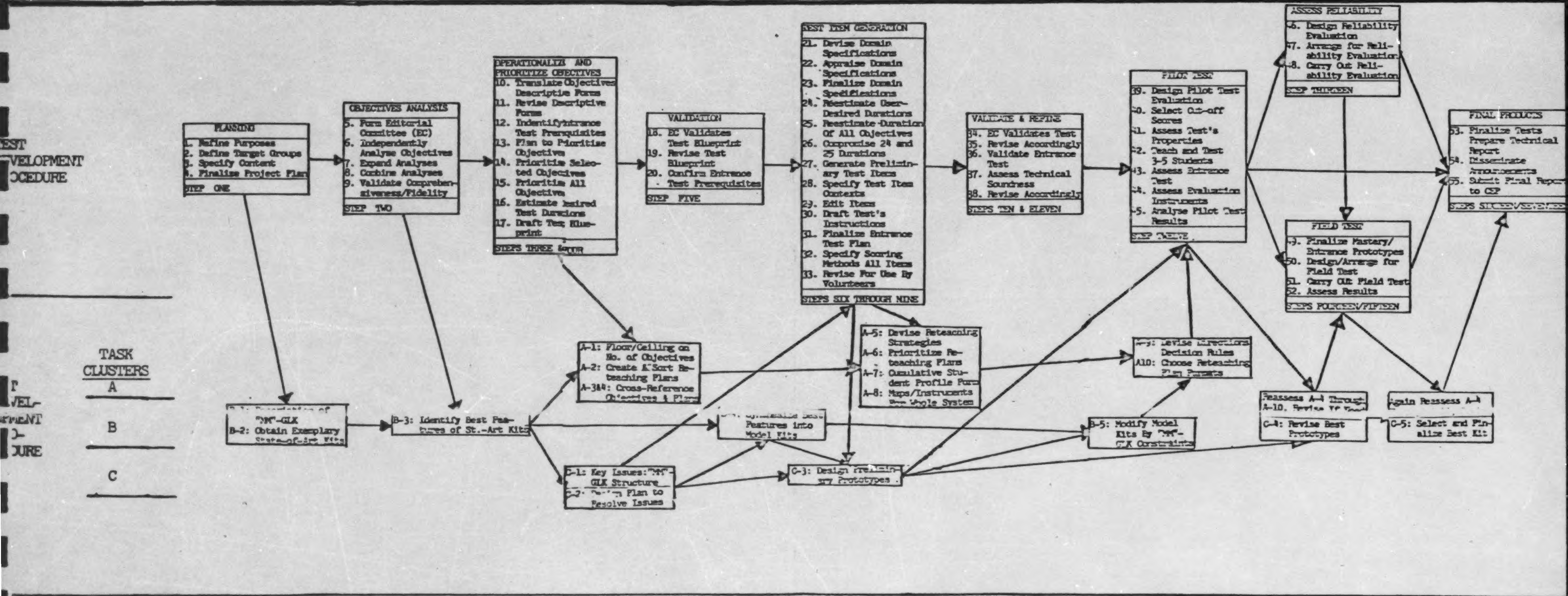
Start with this little Guide and read items referenced herein. Then locate three or four articles on mastery learning, and three or four on criterion/domain-referenced testing, from journals or magazines published within the past three years. This much research on your own should suffice and will pay back big dividends in the future.

Examples of Planning Aids We Used in Our Development Project:

- PERT MAP
- GANTT Schedule of Activities

PERT MAP

DEVELOPMENT PROCEDURES
CRITERION-REFERENCED MASTERY TESTS
"GUIDED LEARNING" RETEACHING SYSTEM


EST
VELOPMENT
OCEDURE
PLANNING
1. Refine Purposes
2. Define Target Groups
3. Specify Content
4. Finalize Project Plan
STEP ONE
OBJECTIVES ANALYSIS
5. Form Editorial Committee (EC)
6. Independently Analyse Objectives
7. Expand Analyses
8. Combine Analyses
9. Validate Comprehensiveness/Fidelity
STEP TWO
OPERATIONALIZE AND PRIORITIZE OBJECTIVES
10. Translate Objectives Descriptive Forms
11. Revise Descriptive Forms
12. Indentify Entrance Test Prerequisites
13. Plan to Prioritize Objectives
14. Prioritize Selected Objectives
15. Prioritize All Objectives
16. Estimate Desired Test Durations
17. Draft Test Blueprint
STEPS THREE & FOUR
VALIDATION
18. EC Validates Test Blueprint
19. Revise Test Blueprint
20. Confirm Entrance Test Prerequisites
STEP FIVE
TEST ITEM GENERATION
21. Devise Domain Specifications
22. Appraise Domain Specifications
23. Finalize Domain Specifications
24. Reestimate User-Desired Durations
25. Reestimate Duration Of All Objectives
26. Compromise 24 and 25 Durations
27. Generate Preliminary Test Items
28. Specify Test Item Contexts
29. Edit Items
30. Draft Test's Instructions
31. Finalize Entrance Test Plan
32. Specify Scoring Methods All Items
33. Revise For Use By Volunteers
STEPS SIX THROUGH NINE
VALIDATE & REFINE
34. EC Validates Test
35. Revise Accordingly
36. Validate Entrance Test
37. Assess Technical Soundness
38. Revise Accordingly
STEPS TEN & ELEVEN
PILOT TEST
39. Design Pilot Test Evaluation
40. Select Cut-off Scores
41. Assess Test's Properties
42. Teach and Test 3-5 Students
43. Assess Entrance Test
44. Assess Evaluation Instruments
45. Analyse Pilot Test Results
STEP TWELVE
ASSESS RELIABILITY
46. Design Reliability Evaluation
47. Arrange for Reliability Evaluation
48. Carry Out Reliability Evaluation
STEP THIRTEEN
FIELD TEST
49. Finalize Mastery/Entrance Prototypes
50. Design/Arrange for Field Test
51. Carry Out Field Test
52. Assess Results
STEPS FOURTEEN/FIFTEEN
FINAL PRODUCTS
53. Finalize Tests Prepare Technical Report
54. Disseminate Announcements
55. Submit Final Report to CEP
STEPS SIXTEEN/SEVENTEEN
TASK CLUSTERS
A
B
C
T
VEL-
PMENT
O-
DURE
B-1: Description of "MM"-GLX
B-2: Obtain Exemplary State-of-Art Kits
B-3: Identify Best Features of St.-Art Kits
A-1: Floor/Ceiling on No. of Objectives
A-2: Create & Sort Reteaching Plans
A-3&4: Cross-Reference Objectives & Plans
C-1: Key Issues: "MM"-GLX Structure
C-2: Design Plan to Resolve Issues
B-4: Synthesize Best Features into Model Kits
C-3: Design Preliminary Prototypes
A-5: Devise Reteaching Strategies
A-6: Prioritize Reteaching Plans
A-7: Cumulative Student Profile Form
A-8: Maps/Instruments For Whole System
A-9: Devise Directions Decision Rules
A10: Choose Reteaching Plan Formats
B-5: Modify Model Kits By "MM"-GLX Constraints
Reassess A-1 Through A-10. Revise If Need
C-4: Revise Best Prototypes
Again Reassess A-1
C-5: Select and Finalize Best Kit

Step or Task No.	SCHEDULE OF ACTIVITIES Initiation Date: October 1, 1980	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE	JUL	AUG	SEPT
A-4 - A-10 C-4	The instructional (reteaching plan) system in the Kit is appraised and prototypes are revised in the light of the pilot test. That system and the physical structure of the Kit are improved yielding two "best" prototypes to be compared in the field test.						▲—	▲					
	The Mid-Term Progress Report is prepared and submitted to the CEP project officer.						▲—	▲					
	A dissemination plan is developed and steps are taken to secure mailing addresses of those audiences to whom announcements will be sent.							▲—	—	—	▲		
	The documentation of the test-development and kit-development processes is reviewed and a methodology is designed for evaluating the processes in order to create a replication manual which will enable others to easily and inexpensively replicate or emulate those processes.							▲—	▲				
FOURTEEN FIFTEEN A-4 - A-10 C-5	The two "best" prototypes of the "MM"-GLK are finalized. Arrangements with field participants are finalized. Participating teachers and tutors attend a workshop to be trained in procedures for recording and reporting evaluation data. Students are taught the "MM" materials and are tested as designed. Teachers and tutors and students are interviewed/observed. Results are assessed and the best features of the two prototypes are synthesized. Final development of the "MM"-GLK.					▲—	—	▲—	—	—▲—	—	—	—▲—
SIXTEEN	A report is prepared describing the criterion-referenced tests' technical characteristics.											▲—	—▲
	The process documentation is evaluated and the Model is developed. It guides the creation of the Replication Manual which is completed and 100 copies are printed.										▲—	—	—▲
SEVENTEEN	Dissemination announcements are mailed, responses are tabulated and acted upon.											▲—	—▲
	The Final Report is prepared and submitted to CEP.												▲—▲

Step or Task No.	**SCHEDULE OF ACTIVITIES** Initiation Date: October 1, 1980	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE	JUL	AUG	SEPT
	A search is conducted for potential participants in the field test beyond those agencies contacted in the course of preparing this proposal; the search is guided by the requirements of the sampling plan.	▲					▲						
	Public communications and education announcements are developed in an effort to involve the community and to raise public awareness of the issues addressed by the project.		▲										▲
EIGHT NINE	Items are generated for possible inclusion in the criterion-referenced mastery tests. Scoring methods are designed for the items.			▲	▲								
A-5 - A-8	The Kit's system of reteaching plans coordinated with possible outcomes of administrations of the criterion-referenced mastery tests is further developed.				▲	▲							
TEN ELE- VEN	The generated test items are subjected to examination for content soundness and fidelity (to establish validity) and for technical soundness.			▲									
	With the cooperation of appropriate agencies in central New York, five students are identified and invited to participate in the pilot test; selection is guided by the sampling plan.			▲	▲								
B-5 A-9 A-10	The B-4 configurations of the best features of other kits are modified in the light of the Project's other test and kit development activities; three or four "realistic" configurations are built into prototypes to be evaluated in the pilot test. Directions for teachers and decision rules guiding master/non-master classifications are developed and incorporated into the prototypes.			▲		▲							
TWE- LVE	The pilot test evaluation is designed, carried out, and its outcomes are assessed and used to eliminate defects and guide the development of two "best" prototypes to be compared in the field test.				▲	▲		▲	▲				
THIR TEEN	Arrangements are made with cooperating schools with students comparable to the target population to carry out the assessment of the reliability of the mastery test items Students are tested in accord with a reliability assessment design developed by the Evaluator and Dr. Gardner.				▲			▲					

STEP OR Task No.	**SCHEDULE OF ACTIVITIES** Initiation Date: October 1, 1980	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE	JUL	AUG	SEPT
ONE	Project Director convenes participants to review and revise the Project plan.	▲											
	Director meets with CEP project officer to clarify any ambiguities, discuss specifics, and develop an understanding and routine process regarding Federal oversight.	▲											
TWO	Develop preliminary blueprint of instructional objectives embedded in LLI's "Money Management" curriculum.	▲	▲										
B-1	Description of the intended "Money Management"-Guided Learning Kit suitable for public communications is developed.	▲											
B-2 B-3	Developers and publishers of comparable programmed instruction, mastery learning, and related systems are identified, contacted, and asked to let LLI borrow or buy copies of their best and most recent products. These are examined and evaluated and their best features are identified (as are their cost-related aspects).	▲		▲									
THREE	The "Money Management" instructional objectives are transformed into "descriptive form". Skills students should have before entering the "Money Management" curriculum are preliminarily identified.		▲	▲									
FOUR	The "Money Management" (MM) objectives are prioritized.		▲		▲								
C-1 C-2	Key issues regarding the Kit's physical structure are identified and plans are made for finding solutions.		▲	▲									
A-1 - A-4	The foundation for the Kit's system for reteaching non-master students the objectives they have not mastered.		▲		▲								
FIVE	The test blueprint is validated.				▲								
B-4	From the best features of the exemplary kits and systems obtained from other publishers, 3-5 configurations of their best features are designed.			▲	▲								
SIX SEVEN	Domain specifications for all objectives are developed, and a range of probably acceptable test lengths is estimated.			▲	▲								
C-3	Physical specifics are specified for the B-4 configurations			▲				▲					

STAGE THREE: PREPARE FRAMEWORKS AND MODELS

ASSUMPTIONS: Organization and funding are in place
Long-Run Goal is to carry out improvements
#1-#7 in Part B, Stage Two.

A. Project Administration

1. Form and orient a Project Review Committee composed of those administrators and top staff who should be periodically briefed on the Project's progress. Arrange schedule of review meetings.

2. Form and orient a Mastery Learning Panel composed of those staff and professionals who are responsible for the course targeted for development or improvement. Define relationship to Project Team and their mutual scopes of responsibility. If the course will be brand new, this Panel is responsible for defining its goals and scope.

3. Refine the development plan to accord with the scheduling realities, personalities, and limited resources the Project will have to deal with.

4. Identify short and medium-range development targets or deadlines and get Project Team members to commit to attaining them on time.

B. Field Work

1. Finalize the identifications of the (kinds of) students who are intended to be the ultimate beneficiaries of the Project's developed or improved materials.

2. Select two (or three) sets of classrooms that are representative of the targeted student population ("target audience"). One set will participate in the Diagnostic

Preview, another in the Pilot Test (and the third in the Field Test if there is to be one). Contact the teachers of these classes and obtain their commitments to participate.

3. Carry out the Diagnostic Preview: all Project Team members visit the first set of classrooms for a few days to observe how those classes normally use existing materials in or related to the course to be improved or developed. Team members discuss advantages and shortcomings of existing materials with students and teachers. Findings become part of the basis for developments of teaching and testing materials.

C. Test Development and materials Development (Joint Effort in this Stage)

1. Test and materials developers work together in analyzing the existing materials to be improved (or the goals for the course to be developed). With the Panel, they identify what it is that the course and materials are intended to teach.

2. They develop models of actual Learning Objectives, the Blueprint of Learning Objectives, Domain Specifications, tests, and teaching materials to be developed in the Project. They work fairly closely with the Mastery Learning Panel.

   a. For existing materials, the developers decide where all possible appropriate breaks are for inserting mastery tests.

   b. For a new course and/or new materials, decide how the teaching of the instructional objectives should be sequenced, and how this sequence should be chunked (how many objectives should be taught in each unit or lesson).

c. Decide on the optimal length for the average test, how many tests there will be in all, and how many items are needed to test, or measure mastery, of each objective.

d. Develop a model domain specification for one or more objectives identifying performance criteria, conditions, and types of items needed.

3. Obtain and examine exemplary mastery learning kits from around the U.S., and locate and read books on instructional design. Identify the best features of the kits, and select the best ideas from the instructional design resources. Develop preliminary ideas of methods for reteaching each lesson and consider alternative format styles.

STAGES THREE AND FOUR TEST DEVELOPMENT

INTRODUCTION

The goal of the test developer is to generate valid criterion-referenced tests (CRT's) which teachers can use to separate those students who have mastered the instruction's objectives (and should advance to the next lesson) from those students who have not mastered the material and need further work.

A CRT's validity is its ability to measure the student's mastery of an instructional objective comprehensively with fidelity. The items in a valid test should elicit behaviors from the student which enable an observer to judge whether the student has or has not learned the instructional objective's competencies, knowledges, and skills. The items in a valid test should measure the instructional objective with fidelity (the test should contain only items which are relevant) and those items should comprehensively measure the student's proficiency in all of the competencies, knowledges, and skills subsumed under the objective.

Comprehensiveness can rarely be perfectly attained. There is no mechanical rule which will automatically break down the typically vague instructional objective into all of its component competencies, knowledges, and skills. Yet the test developer should try to ensure that a test's items genuinely relate to all of the proficiencies which the test is intended to measure. One way to come as close as possible to perfect comprehensiveness is to involve several individuals whose blind spots will cancel out. The CRT test development procedure described here recommends using several judges who complement each other in trying to encompass all competencies to be tested under each instructional objective.

A test lacks fidelity if its items measure proficiency in one or more subskills that are not necessary or essential to the mastery of the objective. Individuals will disagree about what is necessary and essential, about what one must know or be able to do to be called a "master" of a particular objective. Again, the procedure described here recommends using several judges whose biases will cancel out.

1. Develop an outline of the subject's or course's objectives* (Although it is desirable to formulate these as specifically and behaviorally as possible, the goal here is a comprehensive and complete listing of the course's objectives.)

   Form the Mastery Learning Panel composed of all those who either participated in the development of the materials or are responsible for the nature of the courses.

2. The materials and test developers in the project independently examine the current materials and identify the competency, knowledge, and skill objectives they teach.

3. The two developers compare and combine their lists, and they identify objectives that seem to be candidates for deletion, combination, and refinement.

4. The developers submit the combined list to the Mastery Learning Panel; new objectives for the course are added, unwanted objectives are deleted.

   All work together to enhance the list's comprehensiveness (everything to be taught by the course is represented or "captured" by at least one objective) and fidelity (no objectives test things not taught somewhere in the course).

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*For more on objectives, see the Appendix at the end of this section.

5. The test developer then translates each objective into statements that are as behavioral as possible (what you would see, hear, etc. if you observed a true master of the objective demonstrating proficiency in it). The materials developer reviews these translations. The project director settles disagreements between the two developers.

6. The director and the two developers decide how the teaching of the objectives should be sequenced in the materials (e.g., easier objectives should be taught earlier.) Objectives should be deleted which are not
   a. Considered to be important by the project team or the Mastery Learning Panel, or
   b. Perceived as desirable/essential for developing mastery in other objectives in the course, or
   c. Perceived as desirable/essential for learning other competencies, knowledges, and/or skills outside the course.

7. The test developer estimates how much student time is required for testing each objective and adds them all up to get an estimate of total testing time for the whole course, If this is too great (compared to the time students should spend learning from the text), then enough of the least important objectives should be deleted to reduce the total testing time down to a reasonable level. The resulting reduced list of objectives constitutes the test blueprint.*

8. The test blueprint is reviewed by the Mastery Learning Panel for the comprehensiveness and fidelity of its representation or "mirror" of the course, and recommends modifications. The Project Team reviews the recommendations of the Panel and, if needed, adds or deletes descriptive objectives, and revises the sequencing of the objectives.

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*See the Appendix to this section to see how the Blueprint is related to objectives and domain specifications.

9. Develop Domain Specifications. This step expands the descriptive objectives into domain specifications (DS). Each of the test blueprint's objectives must be included in at least one domain specification (DS), but each of them can be included in more than one DS, and a DS can include more than one objective. An objective can contain both knowledges (amenable to paper-and-pencil testing) and skills (amenable to observational appraisals of students using and applying the knowledge). DS's should be spelled out for both paper-and-pencil and application or performance-based items. If the DS is for performance-based testing, then the physical and social context for the testing, techniques and devices for scoring, and materials and performance aides needed for the test should also be spelled out in the DS. (See the examples of such a DS at the end of this section in the appendix.)

10. The test developer reorganizes the blueprint's objectives in terms of test format and environment (paper-and-pencil vs. performance-based), thematic relatedness among objectives, and other factors (personnel requirements, methods of scoring, etc.). The test developer then develops outlines of specifications of all the blueprint's objectives and develops complete and detailed specifications of three typical DS's; two sample test items are created for each of the three complete DS's.

11. The director, materials developer, and Mastery Learning Panel review both the reorganization of the blueprint and the test developer's methods for developing complete DS's. They recommend guidelines for the test developer's further construction of DS's for the other domains. Particular attention is devoted to developing general techniques for increasing the appropriateness of the sample test items as indicators of the competencies defined by the DS's.

12. Estimate average test length.* (This task raises serious technical issues that lie at the heart of the development of CRT's.) The test-length problem is intertwined with two other issues:

    - How to estimate student domain scores; and
    - How to sort students into mastery and non-mastery groups.

    To get a general idea of the technical issues that are at stake, I here quote some passages from Hambleton's** recent overview of the state-of-the-art in CRT development:

"The length of a [CRT] (...the number of test items measuring each objective in a test) is directly related to the usefulness of the [CRT] scores obtained from the test. Short tests produce imprecise domain score estimates and lead to mastery decisions that prove to be inconsistent across parallel-form or retest administrations. Therefore, CRT scores obtained from short tests have limited value... When CRT's are used to assign examinees to mastery states, the problem of determining test length is related to the number of classification errors one is willing to tolerate."

"Estimation of Examinee Domain Scores

Several methods are available for the estimation of examinee domain scores... [The simplest estimates is the examinee's proportion-correct score]. This estimate is highly unreliable when the number of items on which the estimate is based is small. For this reason, procedures that take into account other available information in order to produce improved estimates... would be desirable. [One method utilizes] information gained from the group to which an examinee belongs [the information is the mean score of the whole group]. [This method] may not be ideal since it does not take into account any prior information that may be available... A Bayesian solution... takes into account not only direct and collateral information but also prior information... Direct information is provided by the examinee's test score; collateral information is contained in the mean score of the examinee's group; prior information on an examinee may come from past test performance or the examinee's performance on other objectives measured by the [CRT]... The results of this study bear out the expectation that Bayesian estimation procedures are the most efficient in the estimation of domain scores." (pp. 5-7, 9).

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*For more on this and on how frequently tests should be given, see Appendix.

**Ronald K. Hambleton and Hariharan Swaiminathan, "Criterion-Referenced Testing and Measurement: A Review of Technical Issues and Developments" in Review of Educational Research, Winter 1978, Vol. 48, No. 1, pp. 1-47. (All page references are to this article.)

"Allocation of Examinees to Mastery States

A second major use of scores obtained from criterion-referenced tests is in the assigning of examinees to mastery states or categories. It may appear tempting to first estimate an examinee's domain score, compare it with one or more cut-off scores defined on the domain score scale, and then (for example in the case of two categories) classify the examinee as either a master or a nonmaster. Typically, this is the strategy adopted by individuals implementing objectives-based instructional programs. Unfortunately, this approach is not usually very satisfactory. One reason is that users must assume all classification errors (whether they be of the "false-positive" or "false-negative" type) to be equally serious. This is an unreasonable assumption to make in many instructional settings. For example, with instructional objectives that are prerequisites to more advanced ones in a curriculum, false-positive errors (moving examinees ahead before they are ready) may be far more serious than false-negative errors (holding examinees back, even though they may have "mastered" the objectives in question)." (pg. 10).

The Project team discusses how often teachers and students will want student mastery to be tested as the student progresses, and how much time teachers and students can tolerate for testing, scoring, and interpreting a test given at a typical juncture in the course. The Team devises an "optimal" test duration.

In our own bank checking mastery learning project, we decided to place tests at natural breaks in the content, for example, between the teaching of deposit slips and the teaching of check writing. We discussed various lengths of testing and made arbitrary decision that tests should take about 15 minutes. Perhaps final tests could be longer. We did not know how many items most students could complete in 15 minutes, but we guessed that it would be good to limit the tests to 10 or less items. We recognized the problems this would cause with reliability, but we chose to sacrifice reliability for the sake of making them easy to use.

The Team then sketches both the instructional and the technical pros and cons of the test "optimal" duration. The team compares and weighs the trade-offs of the test durations teachers and students could tolerate versus the sacrifices in technical validity and reliability imposed by that test duration. (The basic trade-off is: shorter total testing time requires either (1) fewer tests (less frequent testing), or (2) testing fewer objectives, or (3) risking larger errors in classifying students as masters and non-masters.

The final decisions about chunking instruction into units or lessons to be tested should now be made. If your instructional material already exists, tests should test whole lessons or groups of whole lessons. (For a poorly designed lesson that should be split up, your test on that lesson will just have to be either too long or too selective in the objectives it tests.) If you are developing the instructional material simultaneously with the test development, then chuncking the instruction should involve considerations of test length and how often tests are given but should not be solely determined by such considerations.

This final chunking or segmenting should be displayed in the Test Blueprint. When the latter displays this segmented testing plan, we call it the Segmented Test Blueprint. You are now ready to develop the actual tests.

13. From the segmented blueprint, the test developer drafts test items in quantities designated by the Step 12 decision regarding test length. For each objective requiring a performance-based simulation format, the test developer specifies the context, performance aids and other resources required by the objective's domain specification. The Team as a whole examines and edits all the items, and develops a draft of the test's directions to students and directions to administrators of the test.

In our letter to potential teachers at pilot-test sites, we attempted to explain what skills students needed to be able to do our checking kit materials (read at a third grade level, and add and subtract 5-digit numbers). We decided against using a placement test. Instead we trusted in the teacher's evaluation of the student's ability. This didn't always work.

We put the directions to the administrators of the tests in the Teacher's Guide. They were very simple, since directions given to students contained all that was necessary for taking the test. Teachers were told verbally that they could explain what the test was asking for if students had difficulty understanding directions or parts of an item. We asked teachers to note such sections that caused difficulty and let us know about them.

14. Prepare a scoring method. If the selections of objectives,

domain specifications, and test items have been carried out correctly, developing a scoring method for paper-and-pencil items is straightforward. Developing scoring methods for performance-based items is more difficult but feasible. The Evaluator and Director collaborate in designing and formulating scoring methods that can be adequately utilized by minimally trained teachers and paraprofessionals without sacrificing their yield of valid information about student mastery.

One teacher used our scoring instruments religiously. This gave her the advantage of being selective in the reteaching materials to which she directed students. On some of the tests, the teacher's score key directed students to specific materials related only to the test item that the student got wrong. Because this teacher carefully used the score key, she was able to devise more efficient learning paths for her students, i.e., students went only to reteachings specifically related to items they got wrong. The other teachers that we observed simply sent students back to extensive reteaching that covered all the content related to the whole test. This slowed student progress and reduced their motivation.

Our decisions about scoring method were guided mainly by considerations of simplicity. Even so, the scoring keys we developed were too complicated for most teachers to use. For example, on the check writing test we had teachers checking each section of the test on a list. Most teachers ignored our check list and simply compared the bank checks to correctly filled-out checks displayed in the answer key, and marked or directed student's attention to places where errors occurred.

15. The final technical challenge here is to decide mastery-level cut-off scores for individual tests. How many items in a test of an objective must the student answer correctly

to be justly considered a "true master" of that objective? Educational researchers and psychologists have not resolved this yet, so you will have to use your own good judgement. Nevertheless, here are things we found helpful to keep in mind:

a. Educational consequences: if mastering this objective is essential or important to learning later objectives in the course (or text), then make the cut-off score (below which tested students are considered non-masters) higher and more demanding (perhaps 80%-100% correct) than you would have made it if the objective did not have those educational consequences.

b. Real-world consequences: if not mastering this objective could result in the student's embarrassment or failure to achieve a practical goal he or she has, then make the cut-off score higher.

c. Reteaching consequences: don't make the cut-off score so high that students who repeatedly fail the test will not be able to relearn the material adequately because not enough reteaching materials are available. Higher cut-off scores mean that more students will not pass the test the first time around, and that students who don't pass are more likely to not pass the second and third times around.

d. We based our cut-off score decisions on our perceptions of how crucial a given skill was to success in the real world. But we made sure that the perceptions of many different judges were consulted to ensure that individual biases and prejudices would cancel out. The more subjective a problem is, the more critical it is for you to involve as many judges as possible to resolve the problem. For subjective problems, "objectivity" means "intersubjective agreement."

16. The Mastery Learning Panel reviews the draft of the tests examining

    a. Its items for appropriateness to student ability levels, appropriateness to the content, and fidelity to the original objectives.

    b. Its directions to students and directions to test administrators for clarity and usability by intended users.

    c. Its scoring procedure for clarity, simplicity, and fidelity to the objectives and to the domain specifications.

    d. The frequency of the testing and the lengths of individual tests.

    The Project Team revises the draft accordingly.

APPENDIX

Preparing Instructional Objectives:

1. An objective is a collection of words, symbols, and/or pictures describing one of your important intents.

2. An objective will communicate your intent to the degree you describe what the learner will be DOING when demonstrating achievement of the objective, the important conditions of the doing, and the criterion by which achievement will be judged.

3. To prepare a useful objective, continue to modify a draft until these questions are answered:
   - -- What do I want students to be able to do?
   - -- What are the important conditions or constraints under which I want them to perform?
   - -- How well must students perform, for me to be satisfied?

4. Write a separate statement for each important outcome or intent. Write as many as you need to communicate your intents.

5. If you give your written objectives to your students, you may not have to do much else.

   Why? Because often students are already able to do what you are asking them to do and will be happy to demonstrate their ability, now that they know what is wanted of them.

Important questions to ask while writing objectives:

1. What is the main intent of the objective?
2. What does the learner have to do to demonstrate achievement of the objective?

3. What will the learner have to do it with or to? And what, if anything, will the learner have to do without?
4. How will we know when the performance is good enough to be considered acceptable?

Developing Domains:

One strategy is to start with prototype items (perhaps extracted from teaching materials) and systematically alter parts of those items to generate sets of equivalent items exemplifying the general concepts or skills supposed to be tapped by the prototype. Next task: determine whether satisfactory performance on each of these prototype items is really an anticipated outcome of the instruction and determine to what extent the list of items may represent a biased subset of some larger set of implicit outcomes. To do this, ask the writer: "Is this what you would like students to be able to do? Is there anything else you would like them to be able to do? In what ways might the items on this list be changed and still get at the same general ideas?" This line of questioning produces sets of items that the writer can classify in terms of general descriptive titles. The resulting pool of items may be large or small depending on the subject matter. It may consist of a sample listing of items or it may be composed by starting sets of rules by which items may be generated. In general, the task is to produce a pool that the evaluator and writer agree upon as representing the central body of knowledge and skill that are the goals of instruction.

Writing Objectives

If you are developing mastery tests for existing materials, it is best to formulate objectives with the author or with teachers who are most familiar with the materials to help the test developer decide what the instructional intent was of each chapter or section. After they explain what they were trying to teach on each subject, the test developer writes the learning objectives in ways that can be useful for testing purposes.

In developing objectives for our kit, we decided that none of the objectives ask students to discover knowledge, but to ask students questions about knowledge that was taught in the materials. A few of the objectives called for students to use knowledge they had gained, e.g. write a check (as they were taught to write checks). Most of the objectives called for students to remember knowledge either by recalling, e.g. fill in the blanks, or by recognizing, e.g., matching/multiple choice.

We decided that all crucial skills, such as filling deposit slip, check writing, reconciling, and endorsing must be learned and tested at the use level. Learning objectives covering these knowledges called for students to demonstrate ability to use that knowledge.

Other knowledges and skills -- such as knowing what a cancelled check is, knowing how to choose a checking acount -- could be learned at the remembering level of learning. For example, students were asked to remember factors involved in choosing a checking account. And to make it easier, we asked them to recognize rather than recall those factors.

Our first list of objectives consisted of 110 stand-alone objectives. This was confusing to the Mastery Learning Panel. So we decided to divide objectives into groups of objectives that would be included on given tests. For example, if we saw need for dividing the existing materials into 10 sections and we planned on having a test for each section, then we would have 10 clumps of objectives. The Mastery Learning Panel was then able to evaluate and rank objectives in each clump, thus helping us developers to weight each test. (By weighting we mean determining which objectives in given tests are more important and should take up larger amount of the test.) The Panel was also able to indicate which clumps of objectives were more important and which deserved minimal or no testing.

Examples of objectives we used for our kit:

Test #	Objectives
1.	Given five blank checks, student will be able to correctly write two checks including: (1) date, (2) check number, (3) payee, (4) dollar amount in numbers, (5) dollar amount in words, and (6) signature.
2.	Student will be able to correctly complete a deposit slip including on the slip: (1) the date, (2) amounts of up to three checks totalling not more than $500, (3) a cash amount, and (4) a total amount.
3.	a. Student will be able to correctly endorse a check intended for deposit only. b. Student will be able to endorse a check for cash. c. Student will be able to correctly write a check for cash using his own name as the payee.
4.	Student will be able to correctly write the following items on a check register: (1) check number (if check), (2) date, (3) description of transaction, (4) amount of payment or deposit, and (5) balance.
5.	a. Student will be able to recognize the process of opening a checking account including: - going to new accounts desk at bank;

- selecting kind of account;
- signing card;
- depositing money;
- receiving checks.

b. Student will be able to recognize the correct procedure for signing the new account card and signing subsequent checks.

c. Student will be able to recognize definition of "endorsing".

d. Student will be able to recall two forms of identification frequently used when cashing checks.

e. Student will be able to recognize the definition of "cancelled check".

f. Student will be able to recognize the definition of "overdraft".

g. Student will be able to recognize what he must do in case he receives notification that he has overdrawn his account.

h. Student will be able to recognize why it is important to keep an accurate current balance of a checking account.

i. Student will be able to recognize the steps to take if he makes a mistake on a check, including:

- write void on check stub or check register;
- write a new check.

j. Student will be able to recognize why it is important to notify the bank if any checks are missing.

TEST DEVELOPMENT PROCESS

Actual example from our process for developing two test items for our Mastering Checking Kit.

I. Start with the "Test Blueprint" of all the tests for the Kit. (Our "Test Blueprint" outlined 5 tests for each of 8 lessons = 40 tests. Below is the third test for Lesson #2 on "Depositing".)

Test 003

1. [25%] Student understands the purpose of the deposit slip.

(Knowledge test item (paper/pencil) required (see page).)

2. [50%] Student correctly completes a deposit slip including on the slip:
   - the date;
   - amounts of up to three checks totalling not more than $500;
   - a cash amount;
   - a total amount.

(Performance test item (full domain specification is required).)

II. Develop domain specification:

DOMAIN SPECIFICATION

Objective

Student will be able to correctly complete a deposit slip including on the slip: (1) the date, (2) amounts of up to three checks totalling not more than $500, (3) a cash amount, and (4) a total amount.

Content/Behavior Domain

1. Student will be expected to fill out two correct deposit slips.

2. If the student has not demonstrated mastery after attempting five deposit slips, he should discontinue testing and go to the appropriate re-teaching strategy. At the discretion of the tutor/teacher, a student might be given two additional deposit slips to fill out instead of being directed to a re-teaching strategy.

3. When a student has filled out two deposit slips which he feels are correct, he will show them to the tutor/teacher for evaluation.

4. Checks to be included on deposit slips will be from fictitious persons or fictitious companies.

5. Student will be directed to use the current date on the deposit slips.

6. A number representing a fictitious cash amount will be given to the student for inclusion on the deposit slip. This amount will be a dollars and cents amount not greater than $150..

7. Student will be given sufficient information for the writing of two deposit slips.

8. At least one of the three check amounts will be for a sum of money in even dollars and at least one other check will be for an amount in dollars and cents.

9. The total on the deposit slips will not exceed $999.99.

Performance Aids

1. The student will be given five blank deposit slip forms.

2. Either authentic deposit slips (possibly the student's own deposit slips) or pseudo-deposit slips will be used. Pseudo-deposit slips should approximate real deposit slips as closely as possible, but should be marked as sample deposit slips. Pseudo-deposit slips should be loose (i.e. a xerox page of deposit slips is not acceptable). If authentic deposit slips are used, they should be destroyed immediately following the exercise.

3. Use of a pen is necessary.

4. At the discretion of the tutor/teacher, the student will be allowed to use instructional materials for assistance while filling out the deposit slips.

5. A blank piece of paper is allowed.

6. Time allowed for writing deposit slips will be at the discretion of the tutor/teacher, but will usually not exceed fifteen minutes.

7. The blank deposit slips will not be attached to a check book.

8. The environment should be centered around a well lighted writing surface.

9. The use of a calculator to add the check and cash amounts will be allowed at the discretion of the tutor/teacher.

Sample Directions

Below are two deposit slip exercises. You will be given five blank deposit slips. If you make a mistake, start over on another blank deposit slip. When you have completed two deposit slips which you feel are correct, show them to your teacher. If the deposit slips are correct, you have probably had enough practice. If there are parts of the deposit slips on which you still need to improve, your teacher will provide more practice. Use today's date on the deposit slips.

1. Suppose you want to deposit the following checks in your checking account:
   - a check for $15 from John Richards.
   - a paycheck for $310.87.
   - You also want to deposit $44.57 in cash.

   Fill out a deposit slip to do this.

2. Suppose you want to deposit the following checks in your checking account:
   - a paycheck for 210.18.
   - a refund check for $13.98 from a store.
   - a check for $55 from Anne Jones.
   - You also want to deposit $71.15 in cash.

   Fill out a deposit slip to do this.

Scoring Key

1. ____Date in Correct location.
2. ____Date correct.
3. ____Check amounts in correct locations.
4. ____Check amounts correct.
5. ____Cash amount correct.
6. ____Cash amount in correct location.
7. ____Total amount in correct location.
8. ____Total amount correct.
9. ____Handwriting legible.
10. ____Numbers clear.

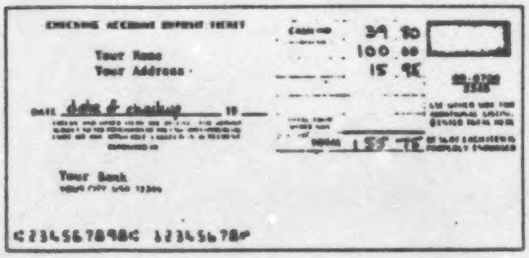
Student is identified as a master of this skill if all of the criteria are marked as acceptable.

III. Develop Answer Key page for whomever scores the test item. The student receives directions (not shown) and two blank deposit slips. Teacher examines student's work and scores it according to the answer key below:

Name____________________________________

Correctly filled out deposit slips:

Deposit slips
003 Score key



Your Name
Your Address

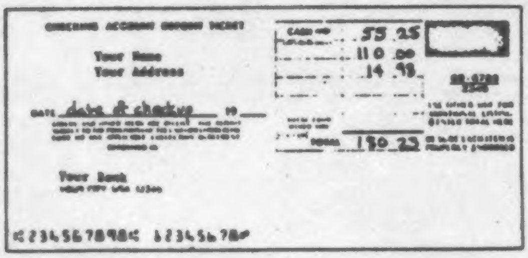
DATE date & checkup 19___

39.90
100.00
15.95
155.75

Your Bank

⑆234567890⑆ 12345678⑈

2.



Your Name
Your Address

DATE date & checkup 19___

55.25
110.00
14.98
180.23

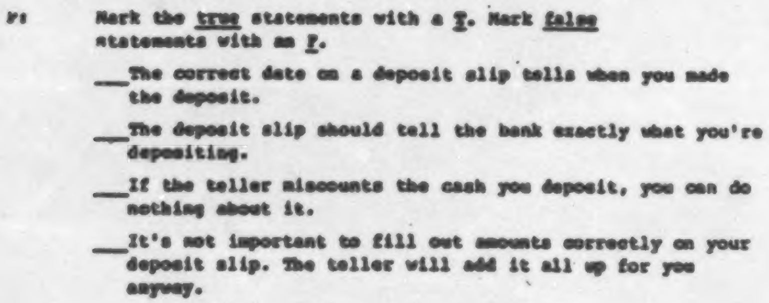
Your Bank

⑆234567890⑆ 12345678⑈

Score	Skill	Green	Yellow	Blue	Review
	Deposit slips correctly filled out				
1.______	Date correct.-------------------------------	17,35	7-9b	20-21	2
2.______	Cash amount correct.------------------------	17,35	7-9b	20-21	2
3.______	Check amounts correct.----------------------	17,35	7-9b	20-21	2
4.______	Total amount correct.-----------------------	17,35	7-9b	20-21	2
5.______	All the above in correct location.----------	17,35	7-9b	20-21	2
6.______	Handwriting legible-------------------------				
7.______	Numbers clear.------------------------------				
	If all items are marked a, go to one of these:----- (or get new assignment from teacher).	18 37-42	10-23	22-32	2-4

For items marked X, go to one of the sections to the right of the item (Or get new assignment from teacher).

Element #1 of the "Test Blueprint" two pages back identified a "knowledge" or cognitive test item (in contrast to the "performance" test item you have just looked at). We developed a simple true/false test item for element #1 and included it as a "practice" in the student's lesson. Below is a reduced replica of this practice ('P') together with a replica of the teacher's answer key page for this particular test item.



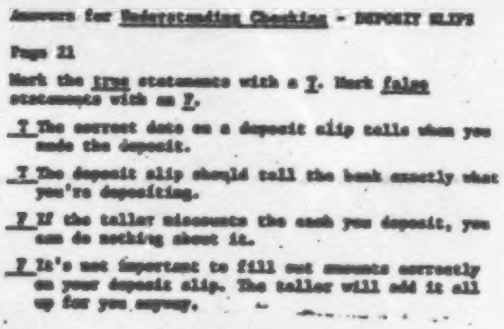
P: Mark the true statements with a T. Mark false statements with an F.

___The correct date on a deposit slip tells when you made the deposit.

___The deposit slip should tell the bank exactly what you're depositing.

___If the teller miscounts the cash you deposit, you can do nothing about it.

___It's not important to fill out amounts correctly on your deposit slip. The teller will add it all up for you anyway.



Answers for Understanding Checking - DEPOSIT SLIPS

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Mark the true statements with a T. Mark false statements with an F.

_T_ The correct date on a deposit slip tells when you made the deposit.

_T_ The deposit slip should tell the bank exactly what you're depositing.

_F_ If the teller miscounts the cash you deposit, you can do nothing about it.

_F_ It's not important to fill out amounts correctly on your deposit slip. The teller will add it all up for you anyway.

Items were also developed for elements #3, #4, and #5 in the "Test Blueprint" section on depositing. All three were of the "performance" type.

Frequency of testing/fear of testing

Early in our project, we wondered about students' attitude toward tests. Contrary to fears, we discovered that very few students resented the tests. Most looked on them as chances to prove they were learning. Some appeared to like the tests and rushed through the materials so they could get to their next tests and prove they could do what they had studied.

Our kit requires that teachers give thirteen tests. Frequency of testing is determined by subjects covered. Since easier concepts and skills are dealt with earlier, the students take tests more frequently near the beginning and are more likely to pass on the first try near the beginning. This keeps the teacher busy administering testing at the beginning. As skills get harder, the interval between tests lengthens and the teacher can breathe a little easier and give greater attention to students as they go through the teaching materials.

We wondered whether we should relieve the teacher by grouping more skills together in the earlier stage, so that those tests would cover more teaching material and therefore come less frequently. This presented two problems: 1. It increased the chance of student failure (the student's early experiences of being tested should be success experiences), and 2. The subject matter in the early lessons did not lend itself to being grouped together.

One solution: teachers make copies of half of the answer keys available to students and let them correct half of their own practices and tests in the early lessons. This alleviates the load of correcting many tests and practices for the teacher and teaches students to take responsibility without depriving the teacher of ultimate control.

Length of tests

Early tests can be brief and relatively easier to ease students into the materials. In the field-test of our kit, success at doing tests was a delightful experience for most students, especially if they were used to failing. If they did fail, the tests were small tests; they did not have to invest much in them and they did not have to cover large amounts of reteaching material to prepare for the next test on the topics they didn't master. It's no big deal to do a three or four question test over again.

Later tests can be more lengthy. None, though, should take over 30 minutes. In the most important tests, the students should actually perform functions they'll have to do as masters of the course's material. This is not busy work, and they get a chance to experience being real masters when they complete these more difficult tests.

COMMENTS ON STAGE THREE: Model Tests, Reteaching Lessons Teaching Plans

Adapting the plan to current resources and needs

Stages One and Two sometimes cover a considerable span of time. Changes occur that require modifications of the earlier plan. Newly hired staff should study the plan carefully at the outset of Stage Three and express their ideas about:

1. Modifying goals (within limits that a person will allow).
2. Modifying procedures for reaching goals.
3. Modifying staff assignments (who does what).
4. Modifying schedules; i.e.,
   a. Changing the order of events
   b. Changing deadlines.
   c. Developing short and medium range schedules (time lines).

To gain support by all members in the project team, give all an opportunity to participate in shaping the plan and defining their roles. Hold them to the major intent of the project, but challenge them to improve the proposal design and set realistic limits on what can be accomplished in light of:

- Their abilities, experience and interests.
- The project's resources (facilities, funds available).
- Needs -- perhaps the sponsor wants to meet needs other than those addressed in the original plan. Needs envisioned in Stage One or Two may have changed. Or the ability to meet those needs may have to be re-evaluated. Or project staff may want to convince the Sponsor to add other needs or replace needs addressed in the plan with alternate needs.

Final decision on content of instruction

Plans in Stages One and Two suggested that the mastery learning material to be developed would cover certain subjects. In light of the time, resources and staff available, were these goals:

- Too broad?
- Too narrow?
- Misdirected?

Decide how much content you can realistically cover (e.g., one aspect of money management rather than the whole field of money management).

Decide what specific areas of content your team is most able to cover, e.g., the team has talent or experience in teaching banking skills but not in budgeting. This decision must be made in light of:

- Project staff's interests and abilities.
- Needs of the audience.
- How easy it is to do one content area as opposed to another, e.g., it's easier to design measurable objectives for banking skills than for budgeting skills.
- Availability of good teaching materials in one subject area but not in another.

If you are not sure how much content you can cover, choose one of the easier content areas and plan to develop it through the pilot test stage. Experience in developing the first content area can guide you in deciding how much more content you'll be able to cover. It will also help you avoid mistakes made on your first efforts, so that development of other content areas will be more efficient and less expensive.

Define instructional intent

Once the content to be covered is decided, then decide what's most important to teach within that content area. Ask:

- What level of competency should the student attain in this content area.
    1. In a range from bare survival competency to expertise in all details, where do we want the students to be?
    2. In what context do we want students to be able to demonstrate mastery?
- What skills and knowledge are absolutely essential for the level of competency we want the students to attain? e.g. in the area of bank checking, must they know how to fill out both checks stubs and registers, or is the ability to fill out check registers sufficient?

- What level of knowledge should they attain on each essential skill or knowledge? For instance, in the area of bank checking,
    1. Using skills: Should they be able to write checks correctly giving a variety of payees, amounts, etc?
    2. Recalling information: Should they be able to recall the purpose of a deposit slip?
    3. Recognizing information: Given a list of items, should they be able to select the items that are important factors in choosing a checking account?

Preliminary selection of important objectives

Consider who should decide key issues in defining instructional intent, and in writing and prioritizing learning objectives. Examples:

a. Project staff.
b. Representatives of the sponsor
c. Publisher's representatives.
d. Representatives of students, teachers, and/or educational programs or institutions who will use your materials.

If the sponsor or eventual users have the power to kill the project because of disagreements over content covered or learning objectives, then they should be consulted in the making of decisions about content, instructional intent and objectives. Certainly these key people should have some input at this stage of selecting most important objectives. Consider whether to convene a committee of representatives from the groups, or to get separate responses from representatives from these groups.

Questions to be asked at this stage:

a. Which objectives are broad?

b. Which objectives can be subsumed under broad objectives?

c. Can any of the broad objectives be eliminated?

d. Can any objectives subsumed under broad objectives be cut?

These questions need to be asked in light of publisher's teachers (buyer or gatekeeper) interest as well as student's need.

Make Test Blueprint

The test developer will want:

1. Enough items per test to make it possible to evaluate that test and its items for reliability.
2. Tests to contain items that demand the same kind of knowledge (using skills in one test vs. items that ask for recall of information on another test).

These wants may conflict with the way the teaching materials should be presented. What if a chapter presents only a few objectives? Should a disproportionate number of items be written to test these objectives to satisfy want #1 above? Or should the test for this chapter be loaded onto a test for an adjacent chapter?

What if a chapter contains objectives on two or three kinds of competence? For example, a check writing chapter could test competence on the use level (write a check), recall level (state the reason for always signing your name the same way), and recognition level (the circled numbers on this check are: a. the account number or b. the check number).

Even though it's awkward to test all of these kinds of competence on the same test, should the content of the chapter dictate the test? Or should you make more than one test for the chapter? Or should you gather miscellaneous objectives from the same kind of competence from a number of chapters and put them in the same test?

(In Mastering Checking, we had a number of recognition level objectives scattered across five chapters which stressed use level objectives. Rather than mixing kinds of competence, we kept the tests for those chapters totally on the use level. Then, in a "review" test, we tested all the recognition level objectives. This forced us to add a review chapter in our teaching materials to go along with the "review" test.)

Conflict may arise between test developer and the materials developer. The latter will want chapter tests that cover all the objectives in a chapter and only those objectives. Or, if two or more chapters are to be tested by one test, then the materials developer will say all the objectives of those chapters should be tested.

The test developer won't be as sensitive to the logic of the content presentation. The materials developer won't be as sensitive as the test developer to the handicaps of chapters with few objectives to be tested or with objectives to be tested for different kinds of competence. Each of these persons should sensitize the other to his/her point of view.

Decide where the breaks should be

This relates to the Test Blueprint, but it deserves special attention.

The blueprint-making process can reveal illogical structuring of already-developed teaching materials. For instance, it may seem more logical to have a test break midway in Chapter One and have another test that covers both the last half of Chapter One and all of Chapter Two. But this will cause problems. Instead, the test and materials developers should work toward making all chapter breaks coincide with test breaks.

Our pilot test observations indicate that tests that come in the middle of chapters cause these problems:

1. Students read on to the end of the chapter before taking the test. They bite off more information than they can handle. The information overload has a negative impact on their test results.
2. Students don't know where to begin in the teaching materials after completing the test.

Evaluating the Test Blueprint

The Mastery Learning Panel should evaluate and revise the blueprint. The Panel should include:

* Authors of existing materials and materials yet to be developed. The former will check to see if the blueprint affords valid testing of what has already been written, the latter have the same concern for materials yet to come.

* Representatives of the sponsor or publisher of the kit.

* Representatives of eventual users of the kit. At this stage, you may have to deal with people who aren't actual students or teachers, but whose experience allows them to speak for the end users.

The purposes of this committee are to:

1. Judge whether the test blueprint (outline of all the tests to be used in the kit) adequately covers all the previously agreed upon objectives that the kit is supposed to help learners achieve.

2. Approve of any changes in learning objectives that came during the process of writing the test blueprint.

3. Suggest changes in the blueprint.

Developing the model reteaching lessons

Write one or two lessons exhibiting the instructional designs you intend to use. Do the main elements of these lessons in as many alternative variations as you plan to eventually use.

Example: A model lesson on using a check register.

Approach A: Use cartoon characters that show how to fill out check register forms. Write instructions in balloons.

Approach B: Use numbered instructions and arrows from the instructions to the parts in the check register which the instructions are about.

Approach A: Break the practices down into sub-skills, i.e., recognizing column headings (date, check #, etc.) one at a time. Filling out a series of check number columns, then filling out dates for each of those checks, then writing description of transaction for each check, etc.

Approach B: Students learn the parts by doing the whole.

> Doing one check at a time, they record
> the whole record for that check, going
> across all the columns each time.

The above explanation of approaches A and B shows the kind of thinking that has to go into development of reteaching materials.

Approach A uses more motivational gimmicks, cartoons, jokes, amusing names on forms, and amusing practice items. This approach is for reluctant readers. It also breaks acquisition of skill/knowledge into small parts, providing practice on learning each part, then integrating the parts into a whole.

Approach B is leaner, more straightforward. No cartoons. Illustrations are used more for informative than motivational reasons. Instruction relies more on words than pictures to convey information. Subheadings, titles, numbered lists and diagrams help readers quickly review each topic. Cues and other study aids tell learners where the main idea, examples, and practice are on each page. In Approach B, each lesson starts with an overview of the topic -- plus an epitomized or paradigmatic example displaying the highlights of what is to be learned. Then it teaches various parts of the topic, relating these to the whole as they are learned. As parts are learned they fill in details of the whole that was initially seen in broad strokes.

Developing the Model Teaching Plan

The design of the tests and learning materials affects how the teacher teaches. For example, if there are no directions in the materials, telling students how, where, and when to begin and continue, then the teacher will be asked to provide these directions.

In a class that's typical of your target audience, try out the alternative sample materials you develop. Have the teacher use them with a student. Observe the tasks the teacher must perform to get the student successfully through the materials. Based on your observations either:

1. Revise the student materials to include directions or other means for guiding the student to do what the teacher would otherwise have to do,

   or

2. Write a teacher's guide which shows the teacher what he or she must do to use the materials effectively.

REMEMBER -

You will probably do some of both of these. When developing materials, you must think carefully about the demands the materials will make on the teachers. This is as important as knowing the demands the materials will make on students. If teachers find the materials hard to manage, no matter how good they are for students, they won't be used.

Decisions to make if you're building enhanced mastery learning around existing materials.

If you already have a basic text or basic series and simply want to build mastery learning around what you have, here are some questions to explore.

1. Are our existing materials too lean for many in our audience? If so, the reteaching materials to be developed need to elaborate it so that students who cannot handle the lean approach will receive more explanation, illustration and practice. What if you discover that the existing material is so lean that

you think it's unfair to test students if they've studied only the existing material? If that's the case either--

a. For cases where you can revise, scrap the existing material, incorporating its better parts in a new basic test; or

b. For cases where you can't revise, add complementary elaborations in separate companion materials that must be used along with the base materials before one takes mastery tests.

2. Are our existing materials too elaborate, i.e., good for slow learners who need abundant examples and practice but boring to other learners in our audience? If so, then reteaching materials would need to take a leaner approach.

   What if you discover that the existing material has much unneeded padding? If you can revise, then delete the padding. If you cannot revise, then tell teachers in a teacher's guide how to route students around the unnecessary sections.

3. Are our existing materials written at a reading level that's too high for many in our audience? If a substantial part of the audience can handle the reading level and all other factors about the existing materials are positive, use the existing material as the Main Text. Then make the Reteaching materials easier to read.

There are other evaluative questions you can ask of the existing materials. Basically what you want to know is whether--

* The existing materials should be scrapped because

they are ineffective and/or inefficient,

- The existing materials are useable if revised,
- The existing materials need no revisions, but should be complemented by reteaching materials that make up for deficiencies in the existing materials or offer variations to match variations in the audience.

If the existing materials can not be scrapped or even revised, and if they are very poor, scrap the project! Don't try to make mastery learning into a pretty package to sell a dead horse. Mastery learning packages are costly to build and they don't work if all the elements in the package are not effective and efficient. Bottom line: make sure that every unchangeable part of the package is instructionally sound.

If you are developing enhanced mastery learning around an unrevisable text...

Though Reteaching Text will use a different instructional approach to present the content, do not alter the order of the reteaching chapters. For instance, in a text on bank checking, you might think the chapter on choosing a checking account is more abstract and should be near the end rather than near the beginning. But, if it's near the beginning in the Main Text, keep it in the same location in the Reteaching Text.

Students and teachers become confused if the topics of chapters in the Main Text and Reteaching Text are not parallel. Guiding students and teachers through the materials is much easier if chapters one, two, three, etc. in the Main Text cover the same topics respectively as chapters one, two, three, etc. in the reteaching Text materials.

The order of presentation within a reteaching chapter may be different from the order of presentation of that same chapter in the Main Text. But each chapter should cover the same topics.

Obtaining exemplary mastery learning kits

How do you find out about mastery learning materials?

a. Search ERIC, as well as indexes of educational journals, for articles on mastery learning.

b. Search ads for educational products in popular magazines, such as Learning Magazines, that go to teachers and school administrators.

c. Telephone or write to key figures in mastery learning and ask them to tell you about latest innovative mastery learning programs and products.

For a model of how to approach these key figures see my phone interview sheet:

Key figures in mastery learning include:

1. Benjamin Bloom
University of Chicago
Chicago Illinois

2. Charles Reigebuth
Instructional Design, Development & Evaluation
Syracuse University
Syracuse, NY 13210

3. David Merrill
University of Southern California
Alta Loma, CA 91701

4. Michael Katims
   Mastery Learning Development for
   Chicago public schools.

5. Ronald Hambleton

d. Call or write to publishers of mastery learning materials.

   1.) Order catalogues that describe what they've done.

   2.) Order samples of what they've produced.

   3.) Ask for addresses of schools nearest to you that are using their materials.

   These publishers include:

   1.) Mastery Education Corporation
   85 Main Street
   Watertown, Mass. 02172
   (617) 926-0329
   (Producers of Chicago Mastery Learning Program.)

   2.) Random House School Division
   201 East 50th Street
   New York, New York 10022
   (Produces Benjamin Bloom-inspired High Intensity Learning System.)

   3.) Westinghouse Learning Corp.
   1500 First Avenue North
   Coralville, Iowa 52241
   (Produces an elaborate mastery learning center for schools.)

   4.) Courseware Incorporated
   10075 Carroll Canyon Road
   San Diego, CA 92131
   (Produces materials using Merrill's & Reigebuth's kind of instructional design.)

Telephone interview format for eliciting information about other mastery learning materials

I'm ______ from ______. We conduct programs [and produce materials] for adults and older youth who are illiterate or functionally illiterate.

Currently I'm directing a project to develop a mastery learning kit covering the subject of __________. The kit is for adult and teen learners who are reading at third grade level.

Here's what the kit will do for teachers:

It will clearly portray the knowledges and skill communicated in the kit materials.

It will provide criterion-referenced tests by which teachers can tell whether students have mastered knowledges and skills.

It will provide reteaching strategies teachers can use with those who have not mastered.

It will enable teachers to:

1. Easily identify knowledges and skills taught by each unit in the materials.
2. Test students to see if they have mastered those knowledges and skills.
3. Reteach knowledges and skills not mastered.

The Kit includes:

1. Student profile sheets which list knowledges and skills taught by the materials so that teacher can record mastery/non-mastery of students in each skill.
2. Criterion-referenced tests which measure student mastery/non-mastery of skills and knowledges.

3. Re-teaching materials (or strategies in a teacher's guide) and that can be used to help non-masters to achieve mastery.

Would you be interested in seeing what we've produced thus far? Have you produced materials like this? How can I obtain it? Do you know others who have produced or are producing such materials?

Their names, addresses, phone numbers.

Reviewing state-of-the-art literature on mastery learning and on instructional design models appropriate for use in mastery learning.

Ask experts such as Bloom and his associates, Merrill, and Reigeluth:

1. Where can I read about mastery learning -- articles books?
2. May I buy copies of your lecture notes?
3. Do you have any detractors whose articles or books I should read?

Search indices of educational journals for articles on mastery learning and instructional design, developments, and evaluation.

Here are some books/materials that may be helpful:

Anderson, Lorin W. & Beau Fly Jones. Designing Instructional Strategies Which Facilitate Learning For Mastery. Paper submitted to AERA Conference, June, 1980.

Block, James H., ed. Mastery Learning, Theory and Practice. New York: Holt, Rinehart, & Winston, 1971.

Bloom, Benjamin S. "Learning for Mastery", UCLA Evaluation Comment, May 1968, vol. 1, no. 2.

Godfrey, L. "Ten Steps to Managing Individualization", Teacher, Sept. 1977, vol. 95, 80-1.

Guskey, Thomas R. & Judith A. Monsaas. "Mastery Learning: A Model for Academic Success in Urban Junior Colleges", Research In Higher Education, 1979, vol. 11, no. 3.

Hambleton, Ronald K. & Hariharan Swaminathan, "Criterion-Referenced Testing and Measurement: A Review of Technical Issues and Developments" in Review of Educational Research, Winter 1978, Vol. 48, no. 1, pp. 1-47.

Hambleton, Ronald K. & Robert A. Simon, "Steps for Constructing Criterion-Referenced Tests", paper presented to AERA, Boston, 1980.

Hassett, Mathew J. & Kathleen M. McCoy, "Task-analysis: A Post-Quiz Remediation Strategy for Personalized Self-Instruction", Journal of Educational Research, Sept/Oct. 1979, Vol. 73, no. 1.

House, Peggy A., "Individualization", Science Teacher, January 1977, Vol. 44, pp. 20-1.

Mueller, Daniel J., "The Mastery Model and Some Alternative Models of Classroom Instruction and Evaluation: An Analysis", Educational Technology, May 1973, Vol. 13, no. 5.

Panell, R.C. & G.J. Laabs, "Construction of a Criterion-Referenced Diagnostic Test for an Individualized Instruction Program", Journal of Applied Psychology, June 1979, Vol. 64, pp. 255-61.

Popham, W.James, "Well-Crafted Criterion-Referenced Tests", Educational Leadership, Nov. 1978.

Identify best features of current mastery learning products and instructional design models

Questions to ask as you evaluate mastery learning products and instructional design models:

1. Will this approach appeal to students/teachers in our audience? (Courseware's work so far is too advanced for slow learners in high school and ABE programs.)

2. Can our audience afford this kind of approach? (Westinghouse's Mastery Learning looks very expensive.)

3. Does our audience have the resources required, forms, to back up the system. (The High Intensity Learning System requires a large library of resource materials to which students go for initial teaching and for reteaching.)

4. What methods of presentation do these materials or models use that would be effective with our audience?

5. What format designs would help us?, e.g.,
   ways of packaging their materials
   ways of guiding teachers and students through the materials
   ways of allowing for copying consummable portions.

Kinds of reteaching method and format options*

Key questions to answer as you consider how to do reteaching:

1. Should the reteaching come mainly from student materials?
    a. If so, should the materials be self-instructional?
    b. If self-instructional, who will evaluate progress -- the student or the teacher (i.e., will mastery tests be teacher-administered, evaluated and scored, or will the student test and score himself)?

    (Perhaps ABE and other adult training programs would prefer that students be on their honor to test themselves and use answer keys to correct and score their own tests. But most high school programs want tests and answer keys under the control of teachers.)

    c. If not self-instructional, to what degree will the teacher manage the use of the student material? (Keep in mind that mastery learning advances masters or moves them to enrichment activities. Therefore students will inevitably be in different places in the materials. Hence teachers will find management extremely difficult if the materials demand a great amount of teacher involvement.)
    d. Should the student materials be consummable or non-consummable? In what ways can a high frequency of practice be provided at low cost? Here are the options:
        1.) Exercises with answers written in the text -- work text.

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*Also, see relevant setions below in Stage Four Comments, pages 74ff.

Make sure you explore these options with knowledgeable outside consultants, or experts in your organization if you have any. There will be room to experiment with innovations in pilot and field testing. But this could be wasteful if an expert consultant could quickly and easily show that innovations are impracticle.

Evaluating the model tests, reteaching lessons, and teaching plans.

The Mastery Learning Panel that evaluated these should be expanded with experts in test development and in instructional design and development.

This evaluation should yield an expert critique of the model lessons produced. It should also provide judgements of features of exemplary bits you have collected. Ask the panel "what do you think of this feature?" questions about the exemplary materials.

Here are questions the experts should answer:

1. What are the good features of the model (or exemplary) materials that should be retained?
2. What features should be eliminated? Why?
3. What features should be modified? In what ways? Why?
4. Will this be effective with the intended audience?
5. Does the material accurately present the subject?
6. Does the material provide enough instruction and practice so users can be expected to achieve the model lesson's learning objectives?
7. Do the tests adequately measure achievement of the learning objectives?

Set tentative pilot test dates and places

Once the model lessons, tests, and teaching plans are evaluated and revised, you will be able to predict when the materials will be ready for pilot testing. By that time, you will also have a sharper focus on the kinds of students for whom the materials will be useful.

Contact appropriate representatives of those who teach or serve this target student population. Through these representatives, contact teachers from whom you can select the teachers who will participate in the pilot test.

Characteristics of pilot test sites:

1. At least one site per each audience you intend to reach, e.g. one ABE class, one EMH class, one high school remedial class.
2. A range of teacher ability. Highly skilled teachers will do many things to compensate for flaws in your materials. Note these compensations and incorporate them in your materials. Very poor teachers will show you how the materials can be misused. This will force you to think creatively on ways to "mistake-proof" your materials.
3. Classes that can devote ample time to using your materials so that the pilot test is not drawn out over a long period. See if you can get teachers to double-up -- perhaps allowing up to two hours a day on your materials so that you can complete the pilot test quickly. But don't push for more than two hours (if the materials would normally be used in one hour periods). Temper your desire for quick results by

the desire to see the materials used as they would normally be used.

4. Classes in which you can observe the materials being used. The teacher must be willing to accept this. Try to find a teacher who would not be threatened or who would not put on a show for your sake. The students, too, must be willing to be observed. In the pilot-test, you will want to have observers at each site on every occasion the materials are used. Therefore the times and places for using the materials must be arranged so observers can always be there.

   Why such steady surveillance? You want to see how each page of the material is used or misused in different kinds of settings.

STAGE FOUR: FIRST DRAFTS AND PILOT-TEST PREPARATIONS

Assumptions: The Sequenced Test Blueprint is complete and has been approved as have also the model domain specifications and test items. The Model Main and/or Alternate (reteaching) lesson(s) are complete and have been approved.

Project Administration

The Project Director:

1. Monitors the test and materials developers and ensures that the instructional and testing components of the system are congruent.

2. Arranges for submissions of preliminary tests and materials to the Mastery Learning Panel for review and either feedback or approval.

3. Arranges, with the materials developer, for the production and printing of the first draft.

4. Assumes responsibility for preparing the pilot-test sites.

Field Work

1. Project Director coordinates the actual kit development schedule with the curriculum schedule planning being done by the pilot-test teachers. (The dates in the pilot-test schedule for initiating the kit's use in each classroom should be staggered to allow for ample observation and discussion by the Project's observation team.)

2. Project Director occasionally conducts, or arranges for, interviews with pilot-test teachers to ascertain details of how materials and tests should be physically and operationally designed to maximize useability in the classroom.

3. Project Director assumes responsibility for the designing of the pilot-test evaluation plan (possibly with the aid of an outside expert evaluation consultant).

(4. If there is to be a field test, the Project Director assumes responsibility for the development of an outline of the field-test evaluation plan identifying the types of students and classrooms to be included in the sampling design. Possible sites are selected (randomly, if possible) and their teachers are approached and invited to participate in the field-test. Extensive help from expert professional evaluators is particularly essential at this and later stages in the field-test.)

Test Development

1. Test developer prepares preliminary items for all knowledge (cognitive) tests, and domain specifications for all performance tests.

2. Project team reviews these products and decides on modifications; test developer modifies accordingly, completes first drafts of all tests and their answer keys.

3. Collaborates with materials developer in writing mastery testing sections of the first draft of the Teacher's Guide for the kit.

Materials Development

1. Materials developer prepares first drafts of the Main and/or Alternate (reteaching) texts, including artwork, formatting, sketches of forms, etc.

2. Project team reviews, decides on modifications, and approves; materials developer modifies accordingly and monitors production and printing of the first draft.

3. Takes primary responsibility for writing the Teacher's Guide; collaborates with test developer in writing the mastery testing sections.

4. Prepares ancillary materials (teaching aids such as overhead projector transparancies, audio/video-cassettes, etc.; student aids such as folders to hold all the elements of the kit, student Progress Sheets, answer keys for student self-correction, forms).

WRITING FIRST DRAFT OF TESTS AND TEACHING MATERIALS

Congruence between tests and materials

Since both tests and materials are deliberately designed to test or teach the same objectives one might assume that they will automatically be congruent. Not necessarily so.

The materials developers should let the domain specifications guide their writing of the teaching presentations. The domain specifications include sample questions. They give a synopsis of what the test will cover and under what conditions the test will be given. Teaching presentations should be designed to prepare students for the tests envisioned in the domain specifications.

But, even with the help of domain specifications, materials and tests can still diverge in these ways:

1. The two developers might give different emphasis to different parts of the topic.

2. The materials developer might choose a format for practice items that differs from the formats chosen by the test developer for test items. For example, all test items may have only one right response in multiple

choice questions while practice multiple choice have only one wrong response. How important is congruence of format? Very! Some students may miss items, not because they don't know the subject, but because they are thrown by the change in format. If you want students to be adaptable to all formats, then teach all the formats explicitly, directly, and deliberately.

Developing reteaching materials for Enhanced Mastery Learning

In enhanced mastery learning, when a student hasn't mastered a unit, he or she goes to a reteaching text. The reteaching text presents the same content as the main text, but from a different perspective. This perspective tends to be more concrete than that of the main text.

In planning reteaching materials, here are some considerations:

1. In general, choose a content area that is very interesting to your audience. One way to do this is to ensure that the content has high utility for them. If you choose an obscure topic - Dutch history or the like - you'll need to make the presentation or treatment of it very interesting if the materials are to succeed.

   If you're not writing the main text, try to choose a good existing one. If you have to settle for something that's rather mediocre, you may want to supplement it with other dittoed information or explanations.

2. The information in the reteaching materials must contain the same core information, unit by unit, as the main text. To put this another way, the main and reteaching materials must each separately contain all the information covered by the mastery tests.

3. In general, a team of writers can do a better job than one writer. Different people have different skills, and a host of skills are required to create good instructional materials. Here are some needed skills: teaching of literacy skills, communications skills, graphics skills, testing skills, sequencing skills... well, it goes on and on. A good strategy is to get one main writer and a few editor/writers.

4. From the beginning, make it clear to all writers that artistry is appreciated, but that artistry must take a back seat to function. If a clever turn of phrase or a brilliant thought doesn't teach, then it will need to be either discarded or revised. Writers will need to get their egos used to that. By the way, allow ample time for revisions.

5. Reteaching materials can range in amount of detail from a completely new parallel text to a few extra practice exercises. Two central issues you must face are (1) how much reteaching will actually be required, and (2) how much can be budgeted for development and printing of the materials?

6. If you don't plan to publish commercially, you may want to integrate some existing resource materials (pamphlets, textbooks, public documents, etc.) into your reteaching materials.

7. Don't spend a lot of money printing your pilot test materials. You can almost be sure that whole sections will eventually need to be rewritten. You will learn a lot about your materials from the pilot test.

8. How teachers will manage the materials is an important early consideration. If you plan mastery learning workshops, the materials will probably be used as you'd like them to be used. If workshops aren't possible, you'll need to figure out ways the materials themselves can guide teachers and students into

mastery learning. Related to this: you'll need to decide what goes into the teacher's guide and what goes into the materials themselves.

9. Somewhere along the line, you'll need to decide if your reteaching materials will be consumable or not. (Materials are consumable if students are allowed to write in them so they cannot be reused by future students.) We chose a middle position. Our teacher's guide suggests that teachers have students write answers in notebooks -- unless, of course, the teachers have a budget to buy new materials for each new class. We decided to print the materials so that they are reasonably durable. If we had decided to make them consumable, we'd have opted for printing them on much cheaper paper.

Writing with the instructional objective in mind

Have the instructional objective in mind as you begin writing a unit. The objective is what you want the student to be able to do at the end of the unit. The purpose of the unit's content is to help the user achieve this performance goal. So ask yourself, "What would it take for the user to learn this?"

Break the unit down into steps. Each new step should build on the previous one. Try to match difficulty level to the abilities (as you perceive them) of the users. As noted earlier, you should try to get to know some typical users prior to writing. Later on, you'll want to make adjustments in the level of difficulty using data from pilot and field tests.

As you think through each step in a unit, consider what intellectual skills or information you are assuming the user must already have. If you realize the user probably doesn't have certain skills or information, break the step down into smaller steps and teach the prerequisite skills or information first.

If you suspect that a part of a unit you've written presents too much material all at once then assume that it does. It's much better to err on the side of presenting material too thoroughly, than to present material not thoroughly enough. Graphics and humor can be a help here. They make what may be a slow lesson more palatable.

Appropriate writing

Most writers who aren't very familiar with below-grade-level readers tend to make materials overly difficult to read. Here are a few good rules of thumb:

1. Words should tend to be short and in common use.
2. Write most sentences with ten or fewer words.
3. Language, when possible, should be concrete. Use examples often.
4. Keep paragraphs short, and separate them with a line of space.
5. Try not to overload pages with text.

Unfortunately, writers for children also follow these rules. So, write in short sentences and simple language. But! DO NOT PATRONIZE! Be careful to write as one adult to another.

Writing with these constraints rarely comes easily. Writers should practice and discuss their efforts with the editor. Chances are that most of what gets written initially will need extensive editorial revision. As with any other writing, the key to success here is to always keep your reader in mind.

Motivating the reader

Many low level adult readers have grown up with a strong dislike for school learning. Don't write as if you expect these readers to hang on your every word. Make a concerted effort to make your materials interesting and involving. Students won't learn unless they want to -- and one important function of your materials must be to cause students to want to learn.

Here are some ways to make materials motivating:

1. From early on, enable learners to appreciate the immediate value of this particular instruction to them by giving concrete examples of ways the skills being learned will help the student in his or her daily life.

2. Also, try to orient learners toward the future. Many of these students live from day to day. Write about long-range goals, consequences, dangers, rewards, and about what the skills being learned may eventually lead to.

3. Choose content and examples which will capture student interest. Relevance should be an important concern. Students get involved in their reading when the materials tell them something they, personally, really want to know. Once again, to write well, you must have empathy with your reader.

4. "Facination" is an exotic word, but it's a good one to keep in the back of your mind. Try to make your materials facinating. Spice them up with the unexpected (but not with the obscure and incomprehensible). Do include, occasionally, curious irrelevancies. Pose thought-provoking questions: "What if...?" Maybe include a story here and there. And so on.

5. Use plenty of examples. Remember that these learners often lack relevant experience in the topic they are studying. Examples help bridge this experience gap. Examples also make materials more interesting (ask any journalist).

6. Use humor, if it's at all appropriate. Humor tells readers that everyone has foibles, not just them. And it makes learning more natural... less "academic". And, of course, most people enjoy humor for its own sake.

7. Suggest various motivational group activities: charts to make, places to visit, learning games, etc. These can be either in the materials themselves, or in the teacher's guide.

8. Do what you can to help users bridge the gap between mastering a skill in the classroom and mastering it in real life situations. For example, you might make suggestions for role-playing, encourage users to try out their new skills in specific non-school contexts, and so on.

Graphic Design

The importance of graphics depends on who the intended learners will be. If the intended learners are motivated and read fairly well, then graphic design can be a secondary consideration. But if they will probably have learning problems, visual design will be important.

Here are a few design ideas:

1. Each set of materials will need a consistent format. For an analogy, think of the format of any magazine. Page after page, issue after issue, there is a consistency: department titles, size of photos, style of type, etc.

   But within the format you choose, create variety. Notice that there are two dangers here. First, if you don't have variety, your format may easily become boring. And second, if you let variety overwhelm the underlying format, the materials become chaotic and unpleasant. To create a successful design you'll need to experiment. As you do, try to get as much feedback as possible.

2. Present information in various ways. Use what works best for each particular item. Some possibilities: regular text, blocked text within a border, charts, graphs, diagrams, lists, bold headlines, illustrations, cartoons, photos. Always keep in mind that you should present material in a way which facilitates memory.

3. You may want to include non-print media (filmstrips, overhead projecturals, records, etc.) with your instructional materials. Utility and cost are the main considerations here.

4. Use graphics for pacing. Pace the students' learning so that after new information has been presented, various perspectives on that information are offered. Illustrations are useful here. Also, think in terms of visual pace and balance. For example, you may want to follow a very crowded page with a page containing much white space. And you may want to place a cartoon after a fairly long block of text.

5. Find an artist you can really get along with. Tell the artist what you want, but don't be too rigid unless drawings need to be very technical. Given some leeway, most artists will give you some pleasant surprises. Be generous in paying him or her. Good graphics can do a lot to improve texts.

Format of the reteaching materials

Rather than try to generalize about possibilities for formats, we prefer to discuss the actual formats we chose for our own Mastering Checking kit. We can fairly well vouch for these since we've evaluated them in classrooms, and feel they have been reasonably successful.

Here are some things about the Checking Illustrated format:

1. Although both can act as main texts, Checking Illustrated is design to be slightly easier than Understanding Checking. We found that the combination of Understanding Checking as the main text and Checking Illustrated as the reteaching text worked well with middle to upper ABE students and with high school students two years below grade level.

2. Checking Illustrated works well as the main text for upper EMH and low ABE students. Checking Practice is the reteaching text for Checking Illustrated and consists of practices, practice tests, and activities. Some of these are slightly easier than those found in Checking Illustrated.

3. Checking Illustrated explains checking in smaller steps than Understanding Checking. To do this, it has to concentrate only on teaching basic skills and central concepts. Other topics covered in Understanding Checking had to be left out to keep the length of Checking Illustrated manageable.

4. Units average about eight pages per unit. Each unit contains anywhere from one to six or more subsections.

5. A mastery test appears at the end of each unit. These "checkups" can be used as practice tests or as official mastery tests by the teacher. Many teachers may prefer to use the "official" mastery tests in the Teacher's Guide because answers to the checkups, and to embedded practice

questions, are in a separate set of answer keys whereas the answer keys for the teacher's versions of the tests are in the Teacher's Guide.

6. Each unit subsection (generally from one to three pages long) ends with a short practice exercise. The format of these practices usually parallels the format of the checkups and mastery tests. As often as not, these practices are skill oriented. For example, if a subsection teaches how to fill out a check, then in the practice, the student fills out checks.

7. The materials include an occasional review unit, followed by a review test.

8. They include a special introductory unit. This unit explains mastery learning and explains to the reader how to use the materials.

9. The early lessons move ahead rather slowly, and the tests are easy. The purpose is to assure early success.

10. We placed a heading at the top of almost every page. This serves to introduce a page's topic.

11. We should assume that some teachers won't read the teacher's guide (our field tests bore this out). That being the case, it is important to try to make the materials as easy to use as possible. Avoid setting up situations where students can't know what to do next without instructions from the teacher.

    One thing we did was to place a stop sign at the end of each unit. This is followed by instructions to the reader which guide him or her to the appropriate checkup.

12. The material uses various visual devices: diagrams, arrows, cartoons, etc. Besides being used for "comic relief", cartoons are sometimes used to impart new information. In Checking Illustrated, cartoons are sometimes used to illustrate process, almost in the manner of a filmstrip. Each step of a process is illustrated and captioned.

13. In Checking Illustrated, few blocks of text contain more than four lines. Sentences and words are short.

Checkups

"Checkups" are one or two page tests which come at the end of each unit. In our materials, additional mastery tests, which are similar to the checkups, are in the teacher's guide. Answers to checkups are on the checkups' reverse side.

The purpose of these checkups is to give both teacher and student frequent feedback on the student's progress. A passing score allows the student to go on to the next unit. A non-passing score indicates that the student should study reteaching material on the same unit.

A progress sheet (in the teacher's guide, for xeroxing) helps the student keep track of his or her progress. It also gives page numbers for both the next unit and for reteaching on the same unit.

Here are a few general rules for writing checkups:

1. Checkups should test for performances outlined in the performance objectives.

2. In writing a checkup, think first of the actual behavior the unit is teaching. As much as possible, the checkup

should test for that behavior. This ideal, of course, needs to be balanced against the need to not tie up the teacher too much of the time. As much as possible, students should be able to learn from the materials themselves. This includes being able to correct and learn from their own mistakes on exercises.

3. One problem with self-instructional materials is that they can't respond to students' spontaneous comments and questions. Therefore, the writer of these materials should leave subtle distinctions and ambiguity to teacher-student discussions. Try hard not to write text or test items where a student could legitimately respond, "No. Whoever wrote this is wrong!" Especially steer clear of true and false tests. In life, things are rarely always true or always false.

4. Try to write checkups and practice exercises at just the right level for users. Know your readers! Checkups which are too easy can be insulting. Checkups which are too difficult can frustrate readers and destroy their motivation. A good test is challenging, but still do-able.

   One of the main purposes of a field test is to gather data which will enable you to adjust each test to the right level of difficulty. By the way, we found that when tests were just challenging enough, students actually looked forward to them and enjoyed taking them.

Embedded practice tests

Embedded practice tests are the little quizzes which come at the end of each subsection. You may want to scatter additional questions within the actual text of the subsections.

We cannot emphasize too much how important these little tests are. They are crucial for reteaching because they keep the student active.

One of the reasons students rebel is that they hate being passive. The quizzes provide opportunity for action and interaction analogous to learning at a computer terminal.

It is very important that students take these quizzes frequently. Without them, poorly motivated students tend to either get lost or distracted. Also, since the quizzes allow most students to succeed most of the time, passing quizzes gives them frequent rewards. Finally, frequent embedded practice tests allow teachers to find and remedy student confusions almost at the moment they occur.

We found that many students read without comprehending. The quizzes get students into the habit of trying to remember and understand what they've just read. The gist of many of the questions you ask should be, basically, "What did that last passage say?" With these readers, one of the goals of your instruction should be to teach them how to study, think, and learn. This is true no matter what the topic of your material is.

Instructional methods we used in our mastery learning materials

We used two models of instructional design developed by David Merrill of the University of Sourhern California and Charles Reigeluth of Syracuse University. They have developed what are known as the component display theory, and the elaboration theory.

The component-display theory* is a prescriptive theory that was developed to integrate existing knowledge about micro design considerations (i.e., considerations for teaching a single idea). It is comprised of (1) six models of instruction, each of which can be used in varying degrees of richness, and (2) a unique system for prescribing those models. The degree of richness of each model is then prescribed on the basis of the difficulty of the objective in relation to the ability level of the students.

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*See Appendix to Stage Four.

Each of the six models of instruction integrates knowledge about how to optimize instruction for one of six kinds of objectives for any given idea: (1) remember an instance verbatim, (2) remember an instance paraphrased, (3) remember a generality verbatim, (4) remember a generality paraphrased, (5) apply a generality to "new" instances, and (6) discover a "new" generality. Each of these six kinds of objectives requires different instructional strategies to optimize learning.

For the most common kind of objective -- applying a generality to "new" instances -- this theory calls for three teaching strategies: (1) present the generality through the statement of a principle or the definition of a concept, (2) present examples of the application of that generality to specific instances, such as demonstrations of the principle or examples of the concept, and (3) have students practice applying that generality to new instances, such as solving a new problem or classifying a new example of the concept. The practice should always be followed with feedback as to whether the student's answer was right or wrong and why. The examples and practice items should be different from each other in as many ways as the student is likely to encounter in the real world; and they should be arranged in a progression of difficulty from easy to difficult (which may include variation in response mode as well as manipulation of variable attributes). Also the generality, examples, practice, and feedback should all be clearly separated and labeled, as opposed to being in a continuous prose passage, in order to facilitate learner control.

The second method we used (elaboratory theory) works like a zoom-lens camera. It gives both a wide-angle panoramic view of a subject, zooms in on one particular part of that subject to show detail, and next zooms back to give the panoramic view and show where the part you just studied fits into the whole. The "lens" then zooms in on another part to study details, and again pulls back to show where the second part fits into the whole or how the second part relates to the first part. And so on.

The example below combines the component display and elaboration theories. It starts out with the elaboration theory's "epitomy" of a major concept to be taught. We do not want to overwhelm learners with detail in the panoramic view yet, so we pull back far enough so that one can only see the outline, the one main feature -- trading is giving something to get something. This main concept is elaborated by visuals and examples. The examples add a bit more detail, so we're gradually moving in closer, but still looking at the whole panorama.

On the next page, we show the whole panorama, but zoom in on one part of the scene -- trading includes exchanging goods for goods. On each subsequent page, we zoom in on another part of the whole, thus adding more and more detail to the whole. In this way, the learner discovers the whole of the subject little by little by seeing the whole in relation to its parts and seeing the parts in relation to each other.

The component-display theory (see Appendix) is also used in this example. We start out with the presentation of a generality (signaled in the lesson with the letter 'i') which states a principle or definition of an idea or concept. The letter 'e' signals the presentation of an example. Finally, the letter 'p' signals the practice which students do to apply the generality to new instances. (The number in the arrow tells learners where to find practice answers.)

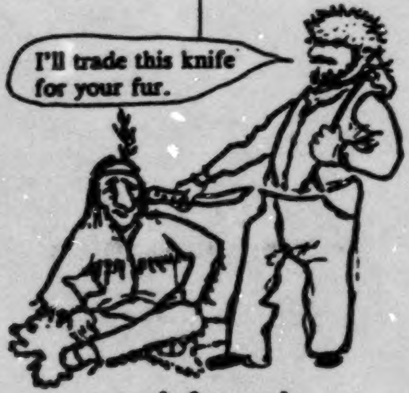
i

Trading is giving something to get something. You give something that you have to someone else. That person gives something he has to you.

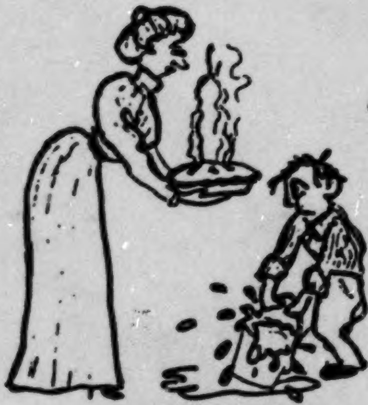
TRADING

something for something

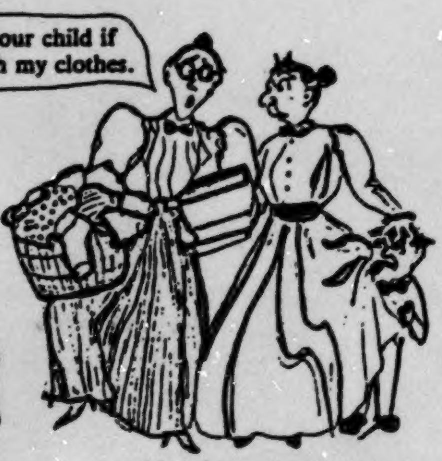
e


I'll trade this knife for your fur.

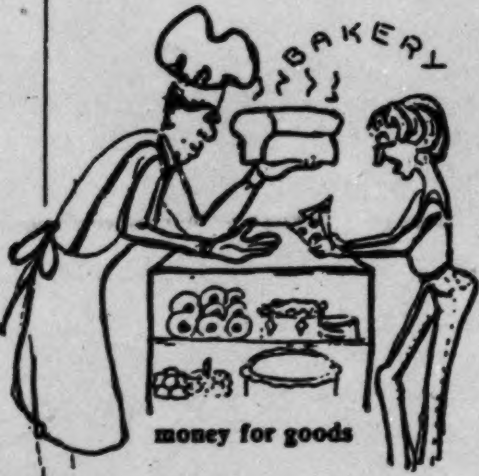
goods for goods



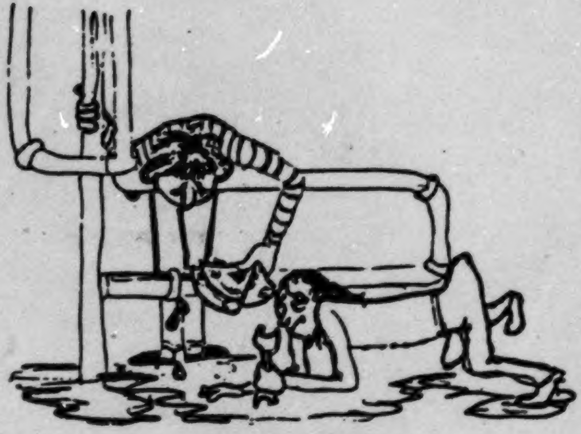
goods for services


I'll tutor your child if you'll wash my clothes.

services for services



money for goods



money for services

p

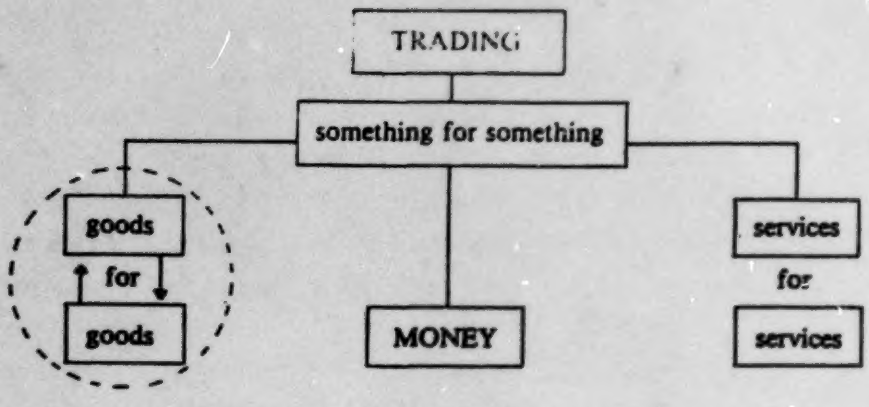
What is trading? Mark (✓) the correct answer.

____ a. It is seeing the good in others' services.

____ b. It is giving something to get something.

____ c. It is giving good service to people.

16


TRADING
something for something
goods
for
goods
MONEY
services
for
services

You've seen that people can trade with **goods, services,** and **money.**

What are goods? Goods are things. You can buy them, own them, and sell them. (*Buying* and *selling* are what you do when you trade.)

These are all goods:

food
clothes
stoves
dishes
toys
books
records
jewelry
soap
perfume
sofas
paintings
cars
vacuum sweeper
bikes
typewriters
desks
tennis rackets
oil
lumber
steel
ships
weapons
airplanes

Mark (✓) any items that are NOT goods in these lists.

1. ____ a. cakes
   ____ b. baker
   ____ c. bread
2. ____ a. sweaters
   ____ b. coats
   ____ c. sales clerk
3. ____ a. books
   ____ b. writer
   ____ c. newspaper
4. ____ a. diapers
   ____ b. strollers
   ____ c. babysitting
5. ____ a. football
   ____ b. coaching
   ____ c. helmet
6. ____ a. cotton
   ____ b. clouds
   ____ c. woolly sheep

16

The idea is to start with a major concept or procedure or principle and then to elaborate upon it until the learner fully understands the concept or principle or knows how to do the procedure. As you elaborate you don't go off on a tangent because you're constantly coming back to the major idea to show the relation between the parts and the whole.

Some students need more elaboration than others. Instruction designed according to the elaboration theory model provides extra materials and strategies which enrich the elaboration. If students can master the objectives with a lean approach, fine. Don't bother them with further elaboration. But if the lean approach doesn't succeed, you provide further elaboration -- different ways of stating or illustrating the main idea, more examples contrasted with nonexamples, different ways of practicing the main idea. The goal is to find some way of elaborating the subject so that the student grasps it. Our kit provides at least three ways to teach each learning objective. No doubt it doesn't provide precisely the kind of elaboration best suited for every learner. But it will come closer to matching individual students' styles of learning than materials that depend on only one approach to the subject.

The component display theory's partitions (i, e, and p) separate the instruction into easily distinguishable displays of components which aid the learner's control of the learning process. If the student learns best by concentrating on generalities, he can easily find that component. If he more quickly grasps a subject by studying the examples,we made it easy for him to find those examples. Perhaps the learner needs to interact with the subject through practice before he can master it. Again, he can easily find the component he'll want to spend most time with. The labeling helps the learner to jump back and forth between practice and generality and examples, finding the component wanted at any given stage in the learning experience.

By labeling and distinguishing these three major components of learning, we help unveil for the student the mystery of learning. Learning is a matter of understanding generalities by looking at examples and nonexamples of the generality. Then you practice applying what you've studied to see if you do understand the generality. If assessment of your practice shows you don't understand, you know what to do -- 1) re-study the generality or have it presented differently, and/or 2) re-study the examples or have new examples and nonexamples given that reveal more completely what the generality is and is not, and/or 3) practice applying what you've studied in new situations to see if you understand.

By explaining this process of learning and showing the components in the process to the student, we not only encourage but actually teach the development of independent study skills. If the student is not mastering, he or she knows what to do to gain mastery.

Experiment with writing and design in the pilot test version

Be sure that you don't try to perfect the materials in the pilot test version. You should have many "which is better?" questions. Try two or more seemingly good ways of presenting an item, direction, illustration, example or whatever. Let pilot test observers, not your personal biases, tell you which way worked best. ABOVE ALL don't let your ego get attached to what you have written. Stay loose and open.

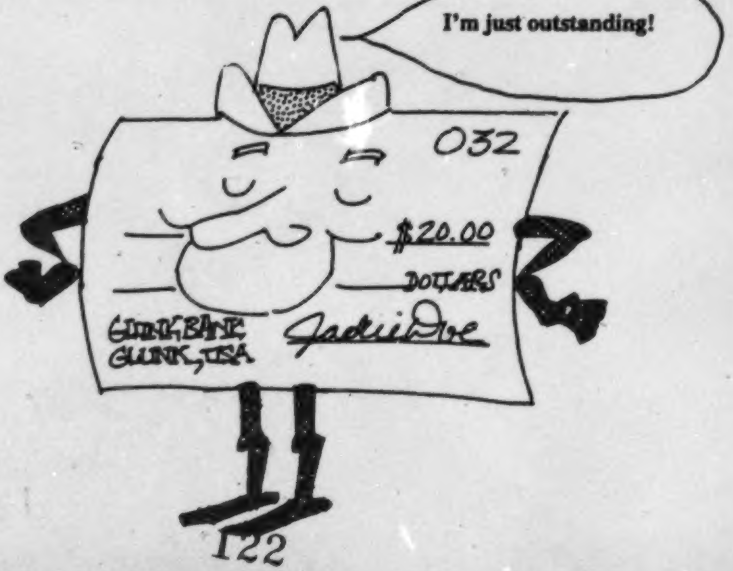
If you can't produce and test a variety of ways of presentation, pick what you think would be the better way and watch during the pilot test to see if it works. If it doesn't work, try one of the other options later in the field test or in a second pilot test.

This experimental approach goes against the normal tendency in book publishing enterprises where a group of authors and editors sweat for long hours over all the "which is better" questions, trying to second guess the eventual users. In developing pilot test materials you are freed from these agonizing sessions. You quickly produce what you think will work best or a number of good possibilities and let the users themselves tell you whether you had a good idea or not. In the end, the facts are better guides than your very best guesses.

SUGGESTIONS FOR WRITING TEACHING OR RETEACHING MATERIALS

Provide the message needed in a way that will be heeded

Deal with issues that are vital to adults and young adults. The tone should be adult-to-adult. Stereotypes, regionalism, and condescending tone should be avoided. Though the subjects of the books may be serious, handle them with a liberal amount of humor. The materials should recognize the intelligence, wit, and richness of experience of the adult learner. As developers of materials, we want to provide an experience for our readers that is fun, captivating, and informative. Above all, the materials should help the reader gain competence in whatever subject is covered. The following illustration shows how a dry subject can be lightened with a touch of humor.



Check 032 is outstanding. Outstanding means it's not on the bank statement. It got to the bank after the statement was sent.

Hook the reader at the start

Try to start each book and each chapter with a solid attention grabber -- something to appeal to the reader's interests and needs -- that will make the reader want to continue.

The beginnings of all chapters, topics, and subtopics should feature concrete, tangible, known things rather than unknown or abstract concepts. In general, proceed from --

simple to complex,
concrete to abstract
familiar to unfamiliar.

Keep it very simple

No matter how clever, no book can hold a reluctant or handicapped reader if it's too difficult. The reading level of our *Mastering Checking* materials is below 3.6 grade level as measured by the Gunning Fog Index. No single page went above 3.9. Most pages were below 3.5. Most sentences contained less than 10 words. The structure was simple. We tried to use no more than two *hard* words per page. By *hard* words, we mean any word with more than two syllables, except for--

1. three-syllable words made up of a two-syllable word and one of the following endings:

   -s, -es   -ed   -er
   -'s, -s'   -ing   -est   -ly

2. compound words of three syllables
3. proper names
4. clusters of initials -- A.F.L.-C.I.O.
5. strings of numerals

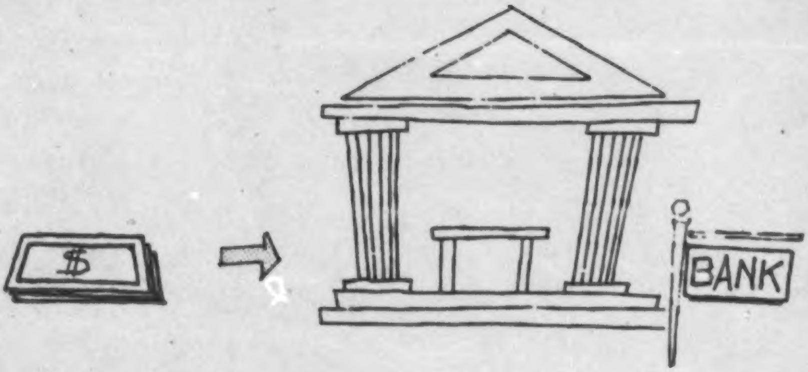
NOTE: Even in our use of one-and two-syllable words, we tried to use familiar words that were easy to sound out.

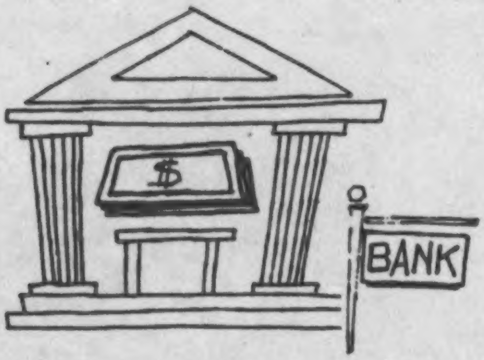
1. Basic checking concepts

What is a check?

Here's how checks work:

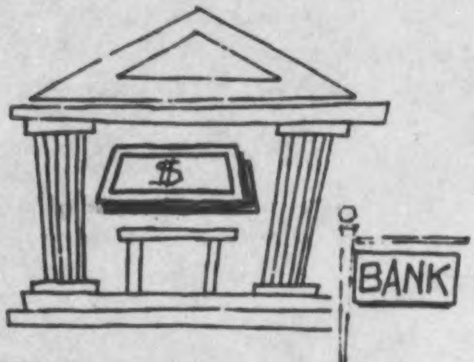
You take your money to the bank.

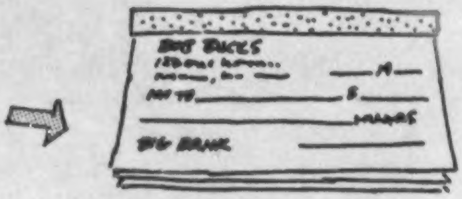


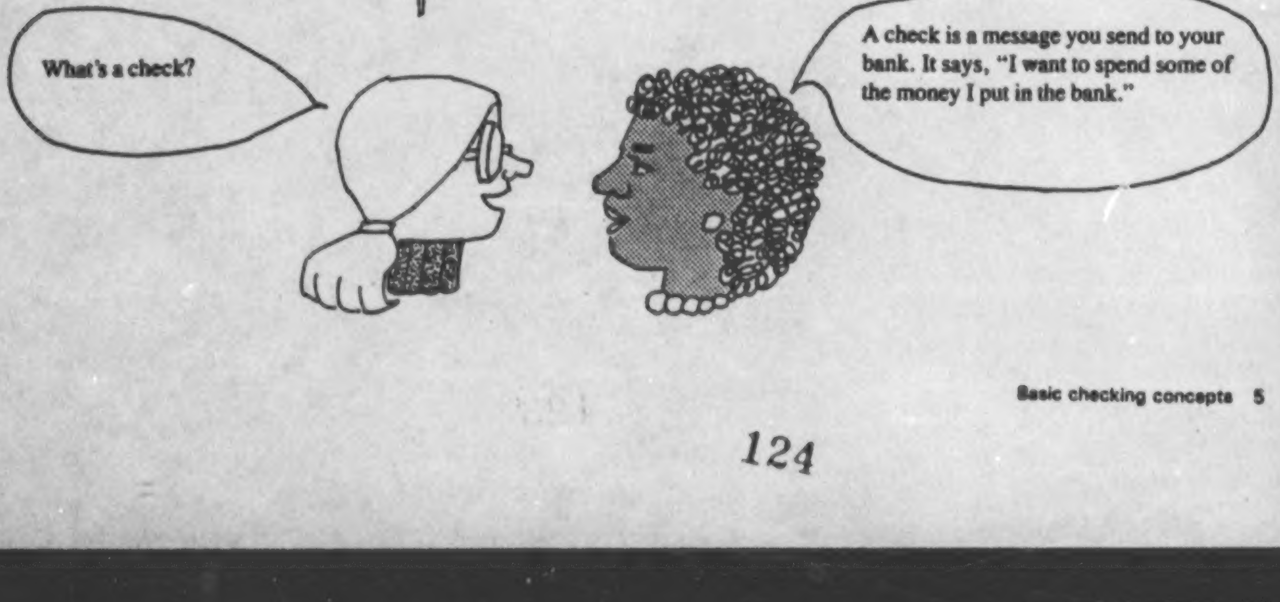


You put your money in the bank.

The bank keeps your money. It gives checks to you.






What's a check?
A check is a message you send to your bank. It says, "I want to spend some of the money I put in the bank."

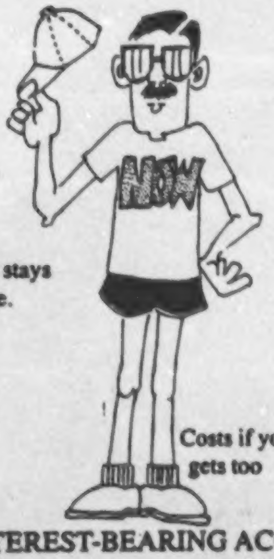
Stress the essentials

Keep asking: what is the bare-bones minimum a person needs to know to achieve the learning objective for this section and to become competent in this subject? It might help to develop a list of the absolutely essential topics. Then do a second list of very important topics that you'd like to include if you have room. Rank the items in this latter list in order of importance. Then if you have room for more than the bare essentials, you can add the higher-ranked topics from your second list. For example, much could be said about the advantages of checks over cash, but look at how we've trimmed this topic down to bare-bone essentials:

Show a lot and tell a little

Present each topic in as few words as possible. Here's where illustrations come to your aid. Depend on them to flesh out your topic. Of course, this means you'll have to think carefully about how to illustrate what you're saying: would a cartoon be best here, or a graph, or a photo, or a line drawing, or a form? How can I show the reader what I'm trying to say?

The following illustrations, taken from a section on shopping for the best savings account, indicate the kind of variety you can use in illustrating your message.



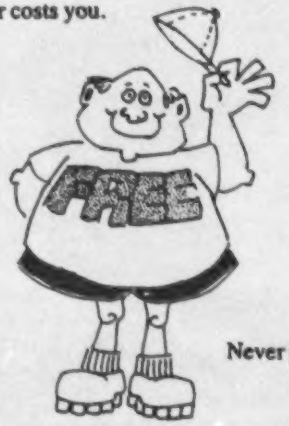
Pays if your balance stays high — $500 or more.

Costs if your balance gets too low.

INTEREST-BEARING ACCOUNTS

Write all the checks you want FREE!

Never costs you.

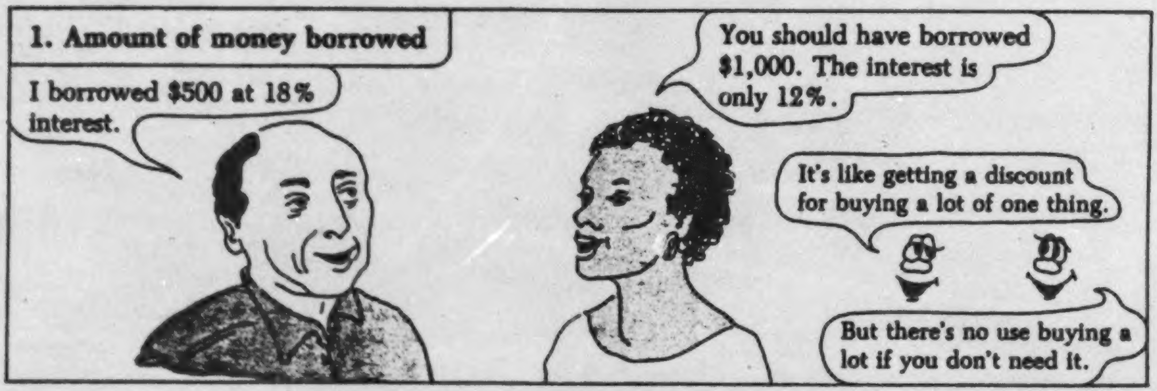


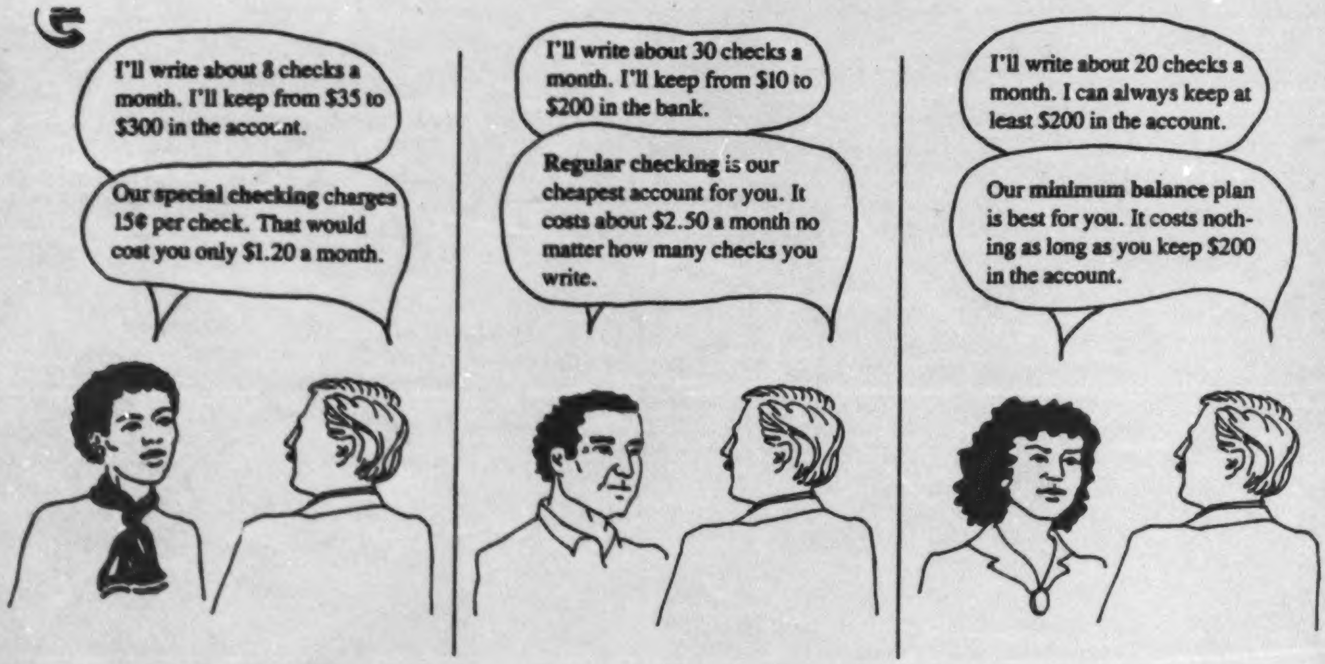
Never pays you.

FREE CHECKING

Favorably reflect your audience

Illustrations, names, anecdotes, and situations should reflect a broad range of ethnic and social categories. By broad we mean inclusive of all who are likely to be in your audience.


1. Amount of money borrowed
I borrowed $500 at 18% interest.
You should have borrowed $1,000. The interest is only 12%.
It's like getting a discount for buying a lot of one thing.
But there's no use buying a lot if you don't need it.


I'll write about 8 checks a month. I'll keep from $35 to $300 in the account.
Our special checking charges 15¢ per check. That would cost you only $1.20 a month.
I'll write about 30 checks a month. I'll keep from $10 to $200 in the bank.
Regular checking is our cheapest account for you. It costs about $2.50 a month no matter how many checks you write.
I'll write about 20 checks a month. I can always keep at least $200 in the account.
Our minimum balance plan is best for you. It costs nothing as long as you keep $200 in the account.

Keep the reader actively involved--reinforcement

Reinforcement is crucial for all learners, but especially for persons in our audience, who need frequent opportunities to prove to themselves that they have grasped what was read. For this reason mastery learning materials provide for continuous opportunity for students to demonstrate their grasp of what they've read.

Exercises should be practical

Exercises should be practical -- filling out the actual forms that students will have to fill out in "the real world," getting into discussion that will truly help them understand or practice what they've read, doing roleplays or other activities that will get them familiar with skills that they will be needing.

The best exercise is one that lets the student use a skill or demonstrate understanding of a concept in a real-life situation. For example, during the course, some learners could actually go out and shop for a bank. Roleplaying can be the next best thing to actually performing a skill. For example, students could be asked to roleplay a job interview in which one student is the interviewee and another student or the teacher is the interviewer.

Some exercises will be pencil-on-paper. Try for variety in this kind of exercise -- multiple choice, matching, fill-in-the-blank, puzzles. In these exercises, we may not see skill demonstration, but we can at least test the learner's understanding of concepts. A general rule of thumb might be: If a section is attempting to teach a skill, e.g., how to write a check or how to open a conversation, then use an exercise that asks the learner to demonstrate the ability to use that skill. If a section is attempting to teach a concept, use a comprehension exercise.

Summary description of mastery learning materials for your Audience

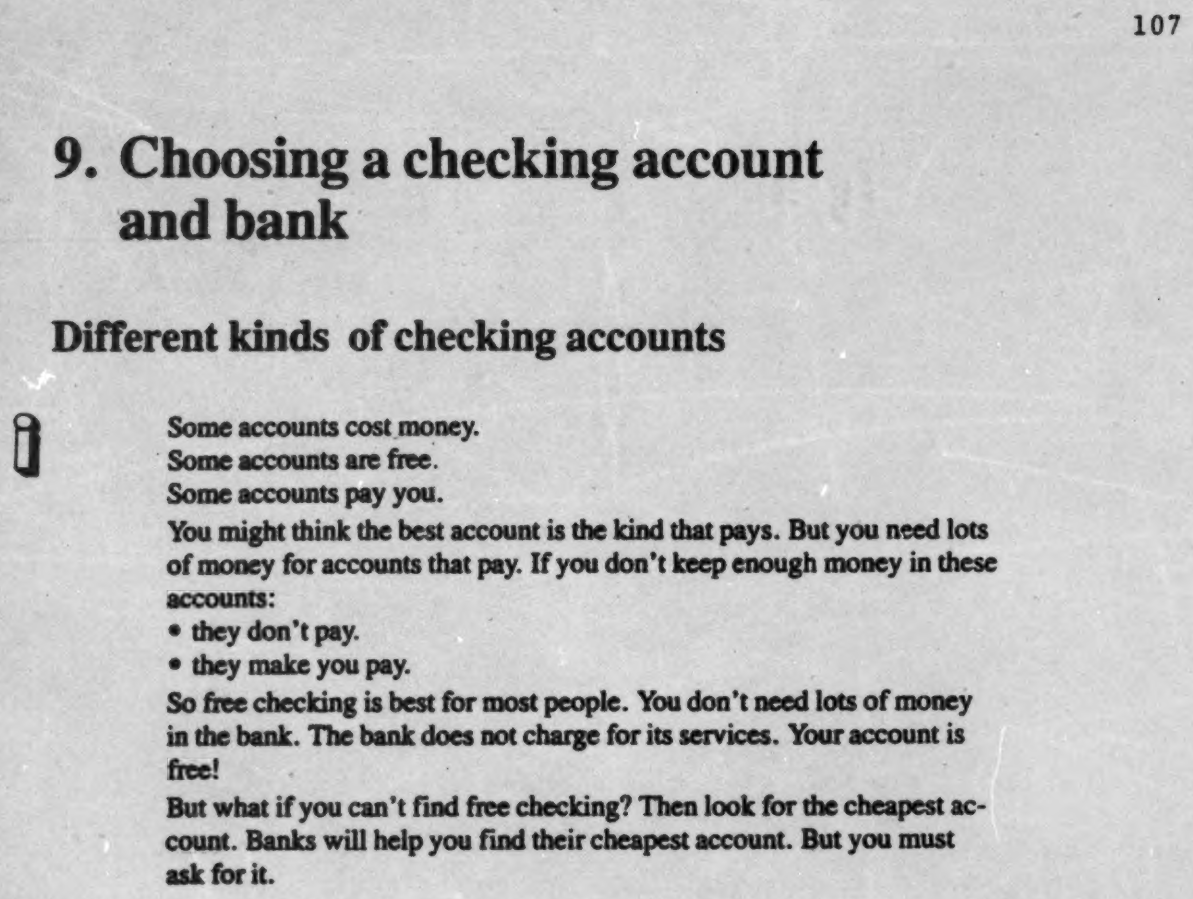
In summary,

present only the essentials of a subject;
break the essentials down into small topics;
illustrate or give written examples of almost every topic;
move from simple to complex, concrete to abstract, known to unknown;
provide exercise for each topic, so students can demonstrate their grasp of the topic for moving to another (this is in addition to mastery tests of the end of each chapter);
get the message across with as few words as possible;
use liberal amounts of humor;
reflect your audience's ethnic and social composition;
emphasize practical learning; and
make the reading level appropriate.

A short course in graphics

Because illustration and design and words are so fully integrated, the author must also be an artist-designer to some extent. You need to do a rough layout of each page in order to know whether your words, illustrations, and exercises will all fit on that page. Here are some suggestions to help you lay out each page.

1. Use headings and subheads. The major divisions in your book will be marked by chapter titles. Topics under each division should be given a heading. And sub-topics should be given subheads. Note the size of chapter titles, headings, and subheads in this section on finding a good savings account:



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9. Choosing a checking account and bank

Different kinds of checking accounts

Some accounts cost money.
Some accounts are free.
Some accounts pay you.

You might think the best account is the kind that pays. But you need lots of money for accounts that pay. If you don't keep enough money in these accounts:

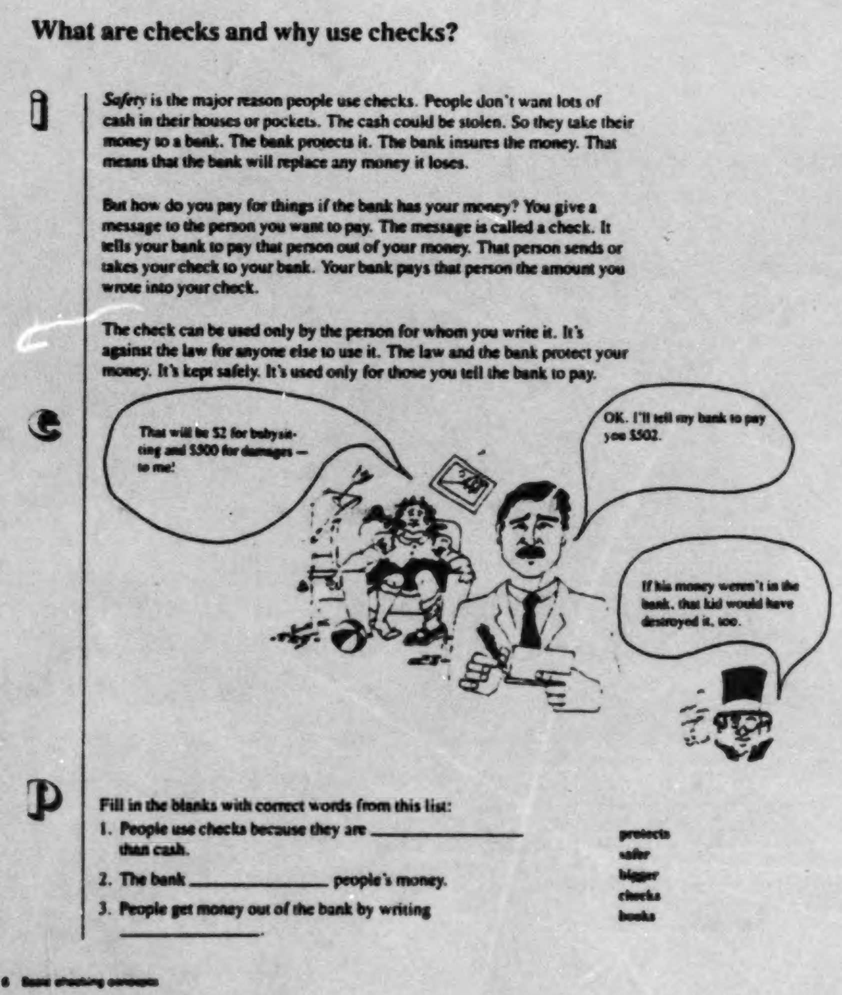
- they don't pay.
- they make you pay.

So free checking is best for most people. You don't need lots of money in the bank. The bank does not charge for its services. Your account is free!

But what if you can't find free checking? Then look for the cheapest account. Banks will help you find their cheapest account. But you must ask for it.

2. Start each page with the beginning of a topic or subtopic and finish each page with the end of a topic or subtopic. Ideally, we attempt to teach one topic per page, illustrate it, and provide an exercise on the topic. Thus, the readers get bit-size portions of information and are given a chance to taste (illustration), chew and digest (exercise) each portion before taking their next bite.

Sometimes we stretch a topic over two or three ages, with illustrations and examples along the way. The exercise then comes on the page on which we've completed coverage of the topic. If a topic stretches over more than one page, then no subtopic should be split between two pages. Subtopics end on the page on which they began. At the top of the next page, you begin with a new subtopic which carries a new subhead. Here's an example of a topic that stretches out over two pages. Note how subtopics end on the page they begin on. Also, note how the exercise comes at the conclusion of the topic.



What are checks and why use checks?

Safety is the major reason people use checks. People don't want lots of cash in their houses or pockets. The cash could be stolen. So they take their money to a bank. The bank protects it. The bank insures the money. That means that the bank will replace any money it loses.

But how do you pay for things if the bank has your money? You give a message to the person you want to pay. The message is called a check. It tells your bank to pay that person out of your money. That person sends or takes your check to your bank. Your bank pays that person the amount you wrote into your check.

The check can be used only by the person for whom you write it. It's against the law for anyone else to use it. The law and the bank protect your money. It's kept safely. It's used only for those you tell the bank to pay.

That will be $2 for babysitting and $500 for damages — to me!
OK. I'll tell my bank to pay you $502.
If his money weren't in the bank, that kid would have destroyed it, too.

Fill in the blanks with correct words from this list:

1. People use checks because they are ________________ than cash.
2. The bank ______________ people's money.
3. People get money out of the bank by writing ______________.

protects
safer
bigger
checks
books

6 Basic checking concepts

Preparing your manuscript

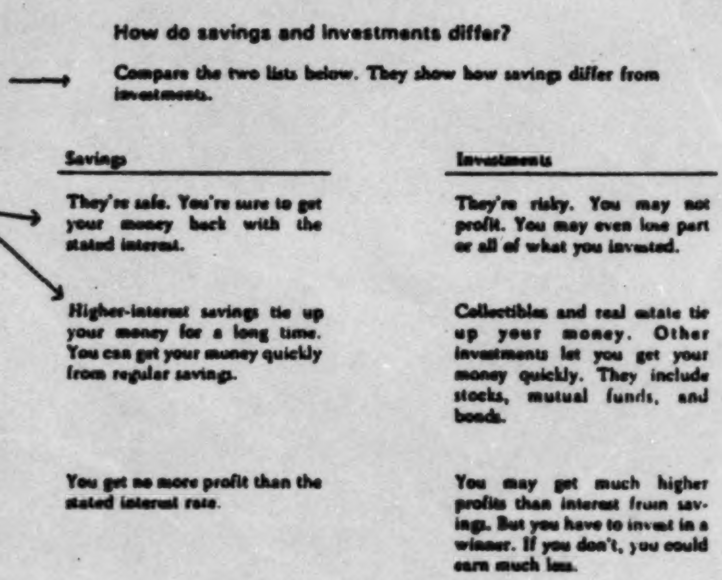
Envision each page as it will be in the final book form so that you can describe all the elements that should go on each page -- chapter title, headings, subheads, illustrations, exercises. Here's how to do it:

> On one sheet, type out all the titles, headings, subheads, captions, text, and exercises that will be used on a given page in the book. Put these elements approximately where they will be on the page. The text can be as wide as 60 characters. (If you set your typewriter margins at 10 and 70, for example, your line will be 60 characters long--maximum width.) If you want text to go alongside of illustrations or to be in narrow columns, type it in narrower columns. (Minimum line length would be about 15 characters). See illustration:

This paragraph is set at 60 characters per line--maximum width for a column of type.

These paragraphs are set at a narrower column width.

When you want a narrower column width, type it accordingly. You don't have to be exact. You'll simply be providing a rough estimate of how the text will look on the page.



How do savings and investments differ?

Compare the two lists below. They show how savings differ from investments.

Savings	Investments
They're safe. You're sure to get your money back with the stated interest.	They're risky. You may not profit. You may even lose part or all of what you invested.
Higher-interest savings tie up your money for a long time. You can get your money quickly from regular savings.	Collectibles and real estate tie up your money. Other investments let you get your money quickly. They include stocks, mutual funds, and bonds.
You get no more profit than the stated interest rate.	You may get much higher profits than interest from savings. But you have to invest in a winner. If you don't, you could earn much less.

More on Graphics for New Readers

When the artist designs the book he or she should remember that our audience is made up of teenagers and adults. "Cute" illustrations on the Bambi level and pictures of children generally have no place in our books. We do not want to insult new readers by implying that they are dumb or childish.

Body type

The type in a book for new readers is important. The reader has supposedly just learned how to read, so the type should be kept simple and right-side up. Research has proven that serifed type faces are easier to read than a sans-serif face. Extended faces are easier to read than condensed faces. Medium width faces are easier than bold, which are easier than italic faces.

Words with all letters capitalized are very hard for new readers. The new reader gets all kinds of clues from the ascenders and descenders. Even headlines should be upper and lower case rather than all caps.

The size of type for a new reader should be 11 pt type or larger. Eleven pt. type should be leaded on 14. The line length should not go beyond about 25 picas. If the line is longer, the new reader's eye will not be able to travel from the extreme right back to the extreme left and hit the correct line.

Teacher's guides can be in 10 pt type on 11 or 12 leading. Ten point type should not go beyond 20 or 21 picas wide. Eight point type can be used for photo or illustration credits, copyright notices, and not much else. Nobody should have to read 8 pt body copy.

Captions (cutlines) or directions should be in a different type face to indicate to the new reader that it is not body copy. With press roman 11 pt body copy we generally use universe 10 pt bold for captions and directions can be done in italic.

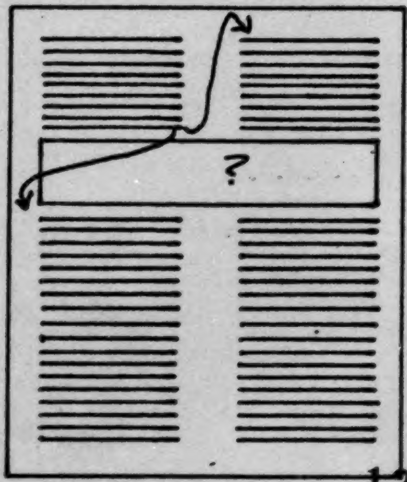
Display type

Display type is usually large enough (24 pt. for example) that the new reader can read a sans-serif face. It is not a good idea to use a really large type (like 72 pt.) for a new reader because they may not be able to connect the letters into words.

A new reader does not yet have good comprehension skills. Sometimes it is too much work for him or her to decode pages of type. Photos, diagrams, and illustrations can provide clues to meaning and a break from the work of decoding.

The layout should not look crowded. The artist can work with the editor to get a balanced layout. The body type should be separated from a cutline by white space so the reader does not continue from the text to the cutline.

Long thin illustrations that cut across the middle of the page are confusing. The new reader will not know where to start reading next.



Where do I read next?
New Readers may not have good enough comprehension skills to figure it out from the meaning of the text

This is intended just as a guide. None of the rules are absolute; there are always exceptions. We want the new reader to discover the joy of reading and books. We want them to want to look at books. So basically as an artist, you should try to design adult-looking, interesting but not confusing books.

Printing costs

New Readers Press tries to keep printing costs down so that we can pass the books along to the newly literate at low prices. Therefore we are dependent on inexpensive design devices. Lines are decorative, inexpensive, and provide information to the new reader, for example: you are beginning a new chapter. Lines can be used many ways for decoration. Type cannot. Extra type or type doing unusual things (like slanting, mirror effect, or shadowed type) can confuse him or her. Type should be used to convey information, not as a decoration.

Consistency of design is a big help to a new reader. It is good for them to be able to identify chapter heads, page numbers, cutlines and other elements by their consistent type face, size and placement on the page.

Photos and illustrations

There are no special rules for the quality of photos or illustrations. New readers in America are visually rather sophisticated. They have been looking at TV, billboards, movies, advertisements, etc. They can't read them, but they can understand the pictures. They're used to all the graphically wild things artists have done. So you don't have to protect them.

The cropping of a photo should not be confusing. Try to not cut off heads, arms, and legs. Do not cut anyone through a joint, crotch, breast or anything editorially important.

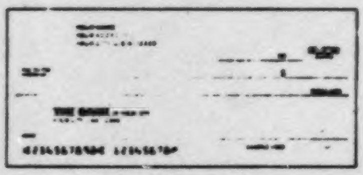
Lay-out

White space should be generously and deliberately used. White space and photos can keep a chapter from being an uninteresting mass of gray type. A new reader is not anxious to plunge into masses of type.

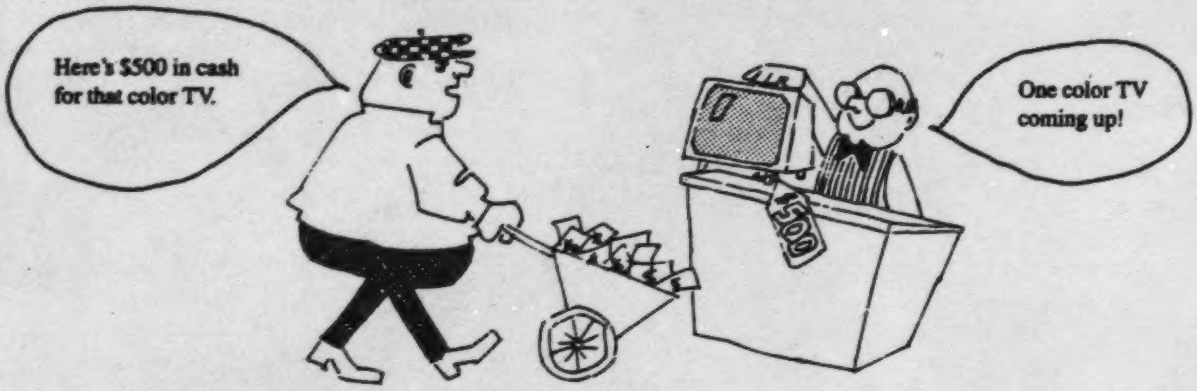
Why people use checks

You can buy things with cash.

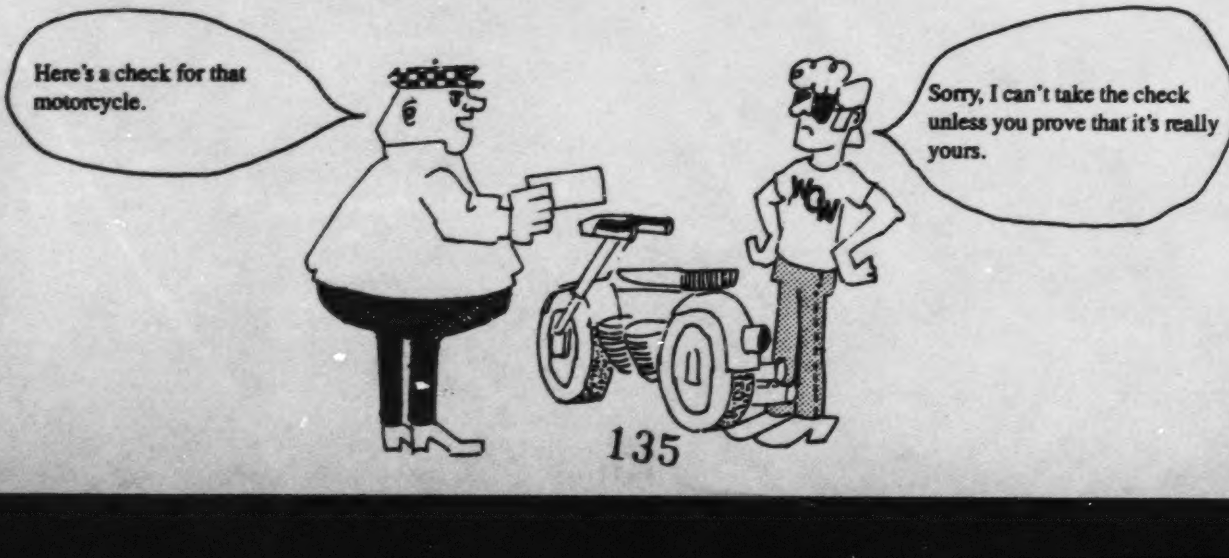
You can buy things with checks.



People can use stolen cash easily.


Here's $500 in cash for that color TV.
$500
One color TV coming up!

People can't use stolen checks easily.


Here's a check for that motorcycle.
Sorry, I can't take the check unless you prove that it's really yours.
WOW

APPENDIX

Excerpts from a handout in the course ITE 600, Syracuse University, Syracuse, NY, 1980; Instructor: Dr. Charles Reigeluth

MODEL OF INSTRUCTION FOR SLOWER LEARNERS

Present a GENERALITY	Then present some EXAMPLES	Then present some PRACTICE ITEMS
-Knowledge that can be applied in a number of specific situations.	-Specific applications of that knowledge in different situations	-Practice in applying that knowledge in new situations.
G	E	P

Example:

An adjective is a word used with a noun or noun equivalent to describe something about that noun or equivalent.	tall building strong desire long game It is great	Underline the adjectives in the following sentences: Bill is very hungry. She likes green cars. He has a happy face.

What is an EXAMPLE?

GENERALITY

An EXAMPLE is a single, specific object, event, or idea. It is a particular one, and there is no other that is exactly the same.

EXAMPLES	NONEXAMPLES
1. My green pen	1. Pens
2. Shakespeare's "Ode to a Nightingale"	2. Sonet
3. $4x^2 - 3x + 2$	3. Quadratic equation
4. (A movie shows a caterpiller changing into a butterfly.	4. Metamorphosis
5. S.U.'s last basketball game.	5. Basketball game
6 Hitting the home run yesterday.	6. Hitting a ball
7. A pen (... is on my desk)	7. A pen (...is needed--any pen)
8 The Great Depression	8. An economic depression

What is a GENERALITY?

GENERALITY

A GENERALITY is a set or class of examples that share some common characteristics.

EXAMPLES	NONEXAMPLES
1. Subtraction	1. 24 - 3 = 21
2. Essay	2. The essay I wrote yesterday
3. Anger	3. The way Johnny behaved yesterday when I spilt water on him.
4. Political convention	4. The 1966 Democratic Convention
5. Volcanic eruption	5. The most recent eruption of Mt. Vesuvius

More About GENERALITY

GENERALITY

When we use the term GENERALITY, we are usually referring to a statement about a generality.

A STATEMENT ABOUT a generality should define, describe, or explain it.

EXAMPLES

1. A sonnet is a poem that (a) has fourteen lines, (b) has a fixed verse and rhyme scheme, usually iambic pentameter, and (c) expresses a single theme or idea.

2. To subtract whole numbers without borrowing:
   (1) go to rightmost column,
   (2) use subtraction facts for whole numbers from 0 to 9 to subtract in that column,
   (3) go to next column,
   (4) repeat steps 2 and 3 until all columns have been done.

3. Volcanic eruptions occur whenever the heat and pressure of molten rock beneath the surface of the earth become great enough to break through to the surface.

4. A quadratic equation is an equation in which the second power, or square, is the highest power to which the unknown quantity is raised.

5. The law of supply and demand states that in a free market a rise in the price of a good will cause a decline in demand for that good and a rise in the supply of that good, and conversely a decline in the price of a good will cause a rise in demand for that good and a decline in the supply of that good.

More About EXAMPLE

GENERALITY

When we use the term EXAMPLE, we are usually referring to a statement about an example.

For the model presented above, a statement about an example should show or explain why it is an example of the generality--it should show or describe all of the characteristics that make it a member of the set or class.

EXAMPLES

1. "Look at the following poem (Shakespeare's "Ode to a Nightingale"). Look at the number of lines, the verse and rhyme scheme, and the number of themes or ideas." (Pause) "It is a sonnet because it has 14 lines, it has fixed verse and rhyme scheme (iambic pentameter and ABBA), and it expresses a single theme or idea.

2. To subtract $\begin{array}{r} 47 \\ \underline{-23} \end{array}$:

   (1) First we go to the right-most column,
   (2) then we use subtraction facts to determine that $7 - 3 = 4$,
   (3) then we go to the next column,
   (4) then we use subtraction facts to determine that $4 - 2 = 2$.

   So our answer is: $\begin{array}{r} 47 \\ \underline{-23} \\ 24 \end{array}$

3. Mt. Vesuvius had a volcanic eruption 18 years ago because the heat and pressure of the lava below the earth's surface there built up to the point where it broke through the solid cap on top of the volcano.

4. $3x^2 - 2$ is a quadratic equation because the unknown, x, is raised to the second power and no higher, $3x^2$.

5. The amount of driving Americans did last summer was lower than the expected because the price of gasoline had risen remarkably. In other words, the demand for gasoline declined because the price rose.

What is a PRACTICE ITEM?

GENERALITY

A PRACTICE ITEM requires the student to apply the generality to a "new" example, where the example is not described or explained to the student.

EXAMPLES

1. "Look at the following poem (Shakespeare's "Shall I compare thee to a summer day"). Is it a sonnet?

2. Do the following problem:

$$\begin{array}{r} 72 \\ \underline{-41} \end{array}$$

3. Why has Mt. Washington not had a volcanic eruption?

4. Which of the following are quadratic equations?

$x^3 - 2x^2 - 1$

$5x^2 - 10$

$3x + 7$

$2y^2 + 7y - 3$

$4x^2$

$2x^2 + 24^2 = 64$

5. Why has the production of houses declined recently?

What is PRACTICE FEEDBACK?

GENERALITY

PRACTICE FEEDBACK is *information* given to a student *after* doing a practice item.

This information must include:

(1) whether the student's work was correct or not,

And --- if it was incorrect:

(2) what the student did wrong, and

(3) how to do it correctly.

Feedback should come *after every practice item*.

Feedback should come *immediately after* each practice item, if possible.

EXAMPLE

1. It is a sonnet because (1) it has 14 lines, (2) the verse and rhyme scheme are fixed (iambic pentameter and ABBA), and (3) it expresses a single theme or idea (her beauty).

2. $\begin{array}{r}72\\ -41\\ \hline 31\end{array}$ This was calculated by (1) going to the rightmost column, (2) using subtraction facts to determine that $\begin{array}{r}3\\ -2\\ \hline 1\end{array}$ (3) going to the next column $\begin{array}{r}7,\\ \underline{4}\end{array}$ and (4) using subtraction facts to determine that $\begin{array}{r}7\\ -4\\ \hline 3\end{array}$

3. Because the lava is so far from the surface that it cannot build up sufficient heat and pressure to break through to the surface.

4. $x^3 - 2x^2 - 1$ is *not* a quadratic equation because the unknown is raised to a power higher than 2 (x^3).

   $5x^2 - 10$ *is* a quadratic equation because the unknown is raised to a power of 2 (x^2) and no higher.

   etc.

5. Because the price of houses has declined (a drop in price causes a drop in supply or production). (The drop in price was also caused by a drop in demand for houses, which was caused by high interest rates.)

STAGE FIVE: CARRY OUT THE PILOT TEST

1. The Project Team collectively:
    - a. Projects when the teaching materials and tests will be produced and copies printed for participants in the pilot test.
    - b. Revises and finalizes the sampling design which:
        1. Delimits the major broad types or categories of students and classrooms that make up the ultimate future student population that are intended to use and benefit from your new mastery learning system.
        2. Specifies the classes that will serve in the pilot test as representatives of each category (preferably include three representative or typical classrooms in each category).

2. The Project Director notifies the participating teachers of those classes about the project schedule for
    - a. Starting-up the use of the first draft in each participating classroom.
    - b. Visits to the class by the observation team prior to those start-up dates.

      These prior visits will enable the observation team to
        1. Let students get acquainted with the members of the observation team and used to this new experience of participant observation.
        2. Observe how students normally interact with regular printed materials used in those classrooms.
        3. Teach individual students to candidly express their thoughts out loud to individual members of the observation team while they're studying

and taking tests without developing dependencies on the observer for help.

(Note: the schedule may have to stagger the start-up dates at some of the sites if that is the only way for each class' first week using the first draft to be completely observed by the observation team.)

3. The first draft is carefully edited and copies are made and packaged in a form that approximates the look and feel of the materials as they will ultimately be produced.

4. The Project Team collectively discusses issues that they think at this preliminary time they should keep in mind when they eventually start observing the first draft in action in the pilot test classes. (See suggested examples of these issues in the Appendix to this Stage.) This is the beginning of the evolving "Observation Checklist" that will be continually re-evaluated and revised over the course of the pilot test.

5. Just prior to the start-up dates, participating teachers should be briefed on exactly what is expected of them and how you want them to help you. Make them part of the team and invite them to plan on sitting down with the observation team after many of the observation sessions to discuss what happened, and to brainstorm ways to improve the section of your first draft that was used that day.

6. Observation team leader(s) delivers each participating teacher his/her class set of the first draft, Do not explain what you are delivering or otherwise help the teacher in any way beyond what you expect future teachers in your target population will themselves be able to learn about your materials from whatever advertisements you expect you will be distributing or from other

kinds of announcements, presentations, teacher-training workshops, etc.

7. The observation team(s) conduct site visits using multiple participant observation methods. They should also carry out well prepared and well planned, but brief, interviews of each teacher at the end of the class (if possible) or soon after while things are still fresh. Ask teachers to identify problems and suggest solutions. Team members should take copious notes to record their observations and should discuss among themselves their respective observations and interpretations regarding both the issues in the Observation Checklist and new issues that have arisen in their minds. Observation Checklist issues are annotated with the day's findings or are deleted if found to be irrelevant; new issues are added if the team so decides.

8. When all sites have completed the course, bring participating teachers together for a wrap-up discussion of outstanding issues. Get them to identify the most severe problems and to suggest and evaluate alternative solutions.

9. The Project Team collectively assesses all findings of the pilot test based on their own copious notes, teacher suggestions, and teacher contributions during the wrap-up discussion. The team condenses and refines formulations of the most important feasible proposals for revising the materials and tests.

COMMENTS ABOUT THE PILOT TEST

The pilot test gives you a chance to find out if your creation really works as well with students and teachers as you have been hoping and predicting. In creating the first draft, the developers have tapped their own experiences and talents as well as the good advice of others. But their beliefs about what will help students learn actually amount to good guesses and speculations.

The pilot test injects trial-and-error experimentation into your development process. The first draft of the materials and tests represents your best bet, but it is still a gamble. It's a proposal you are putting on trial. Look at the pilot test as a dry-run laboratory experiment for detecting the bugs and problems you cannot see when sitting at your desk. Don't look at the first draft as the final perfected product of your labors. Spend less time at your desk agonizing over fine points in the first draft, and spend more time observing students and teachers interact with your creation.

Remember that a pilot test is not classical research. You are not trying to grade or rate the effectiveness of your materials in comparison to rival materials or teaching strategies. In a pilot test, you assume that your materials are generally OK; your goal is to find out how to make them even better.

If you work at it, you will be able to make your pilot test the most significant and rewarding part of your whole project. Here are some suggestions for making this come true based on our own experiences in our pilot test.

FIRST, remember that you would like to find out what students and teachers are really thinking when they interact with your first draft. But, since you cannot telepathically eavesdrop on *their* private thoughts, you should try to gather as much "objective" and publicly observable evidence as you can about what they are thinking.

The observation strategy we urge you to adopt is a strong form of multiple participant observation. Forget about "Hawthorne Effects" and other impacts your observations have on students when you interact with them. You are trying to detect differences among the impacts on students caused by differences among the elements of your first draft. These differential impacts will still surface whether or not your presence makes students feel abnormally alert and motivated and want to please you.

On the other hand, "participant observation does not mean that you should do more than observe. Observe without giving students or teachers special help when your materials fail. Do not present yourselves as experts on whom students or teachers can become dependent. Don't rescue them when they get into trouble. (You might help them that time, but in doing so you might also be training them how to overcome the same defect when it recurs repeatedly later on. The next time they encounter the defect they will know how to overcome it, but you might overlook it on that and all later occasions. Future users of your materials will suffer because you did not know to correct those later defects.)

You can't be kind to pilot test participants without being unkind to many more unseen future users. And you will end up with inferior materials ... so, observe, but don't help.

SECOND, visit pilot test classrooms several times before the teachers start teaching your first draft so you can develop rapport with the students and enable students and teachers to become accustomed to your participation. Get teacher permission to approach and interact with students when they are working on their own with other materials. In sum, construct the desired relationship with the pilot test classes before your materials are introduced.

As a corollary, remember that you are "teaching" students how to freely converse with you, to think out loud to you, while they are interacting with printed materials. Tell them that that is what you would like them to try to do, to freely think out loud; of course, whenever they do appear to be trying to do this, reward them regardless of the content of what they actually say. Make positive reinforcement the rule.

THIRD, ensure that "observation teams" are composed of at least three members of your project team. A minimum of three is required because different observers will be sensitive to different aspects of classroom interactions and will relate differently to different kinds of students. Three or more observers in each classroom observation session will ensure that most of the deficiencies in your first draft are detected. Also, individual biases among three or more observers will tend to cancel out each other thereby increasing the "objectivity" of your findings.

FOURTH, pay close attention to how teachers score the mastery tests at the end of each lesson and then make decisions about whether the student has mastered the lesson and should move on to the next lesson or has not mastered the lesson and should instead relearn the lesson's content by studying a reteaching lesson or doing extra practice. You want to watch for ways to make your materials discipline teachers so that they neither prematurely advance non-masters nor hold back true masters.

FIFTH, be on the look-out for times when your mastery tests say that certain students are masters or non-masters who teachers "are sure" are not true masters (even though they "passed the test") or "are sure" are genuine non-masters (even though they "did not pass the test"); the teachers may be right and your test may be rendering false judgements.

Remind teachers (and yourselves) that each prototype test is being *put on trial*. It is not necessarily better than the teacher's own intuitions and judgements. Take special pains to ask teachers which tests seem to produce results that are at odds with their own assessments of their students.

Generally make teachers feel that they are part of your team and persuade them that they share in, and have a stake in, the whole enterprise. Interview them after each observation session and convey to them that you are taking their testimony very seriously. Only they really know individual students in their classes and can spot things your observers overlook or misinterpret.

SIXTH, observe, and ask teachers about afterwards, *how manageable* your materials are in the context of normal classroom dynamics. Our own kit was at the cutting edge or unmanageability. We gave students three texts under separate cover to choose from for learning the same lesson. Each lesson in each of these three texts had its own exercises and its own mastery test. Teachers had to grade both the different exercises and the different tests individually for each student. Also, students worked with separate forms (sample blank checks, deposit slips, etc.). To make things even more complicated, each student moved through the texts at his or her own pace, so students in the class were generally working at different places in the course. Finally, each student had his or her own "Student Progress Sheet" on which the teacher had to record whether the student passed or did not pass each particular mastery test and had to indicate which of the three teaching texts the student should next move to depending on how he or she did on the mastery test.

This was kind of a "worst case" maangeability arrangement for the teacher. Our observations in the pilot test led us to radically simplify the system and reduce the management problems for teachers. You also will want to observe teachers using your materials in your pilot test to learn how you can make your own materials more manageable and efficient without compromising their instructional integrity and effectiveness.

SEVENTH, spend time before the onset of the pilot test to work up a preliminary checklist of questions and issues for observers to keep in mind while they are observing students and teachers interact with your first draft. Continually revise, refine, and update this observation checklist so that it becomes a diary or journal of the pilot test as well as a continually improving record of your findings. This process will not only make members of your observation team more alert to the broad variety of potential trouble-spots they might encounter, but will also tend to consolidate the individual viewpoints of separate observers into a common project-wide perspective. This process will additionally help you separate problems with particular words, sentences, and paragraphs in the teaching materials, and problems with particular test directions and test items, from systematic problems that recur throughout longer sections of the first draft and require systematic correction.

For examples of issues you might want to consider for your own observation checklist, see the Appendix to this section.

EIGHTH, You have hopefully selected classes for participation in the pilot test which meet the following requirements:

1. The classes are typical or representative of the classes or groupings of students that you intend your materials to be used by in the future. Pilot-test students should resemble your target future student audience in ability level, level of educational attainment, and socio-cultural and demographic characteristics.

2. Pilot test classrooms should also resemble your targeted future classrooms in the size of the classes, the number

of teachers/aides/paraprofessionals present in the classroom, and the physical and scheduling characteristics of the host school or institution.

Divide your targeted students and classrooms into salient types or categories. For each type, find three classrooms which resemble that type to participate in the pilot test.

3. Within each type, try to choose three teachers who appear to represent a cross-section of ability and teaching style. The least effective teachers will provide an acid test of your Teacher's Guide and the manageability of your first draft. The most effective teachers will devise ways to correct or compensate for deficiencies in your materials that will give you good ideas about how to improve them.

4. Ensure that you have a manageable and not too numerous group of pilot test sites. You should try to have an observation team observe each site's first week of work with your first draft, so you should stagger the initiations of the course at the different sites. Your project team should expect to spend 75% of total project time during this pilot test period sitting in those classrooms and observing your materials in action. A good ratio is one observation team (with three project team members) for three or four sites. After each site has moved beyond its first week with your materials, ensure that the team visits it at least once during each subsequent week for the duration of the course.

5. Finally, ensure that your materials are pilot tested during a fairly "normal" period in the school year, not at the beginning or end of the year (semester) or near Christmas.

NINTH, try to produce your first draft at as high a level of production quality as you can afford to make it. Use good print quality and good binding. No typoes, handwritten words, or crossed-out sentences. Even though it is a "first draft," it should look like a finished product to the extent that you can afford to do this. If you don't do this it will be very difficult for you to determine whether students and teachers in the pilot test are having problems or expressing confusion or negative reactions because of defects in your instructional system, or because of rough or clumsy physical defects, in your first draft manuscript.

Recommendations from the leader of our own observation team

Have the observation team discuss what to look for during the pilot test. Watch out especially for gross problems in the tests--confusing directions, test items that were confusing or failed to clearly indicate student's ability, test administration problems.

Observe each session when pilot test materials are used. Have your presence explained as people who are developing materials and want to find out how to improve them. This honest explanation might influence how students perform, yet this is better than forcing teachers to say you are something that you are not.

Rather than remotely observe, be participant observers. When you see a student in trouble, go to the student and ask if you can help. This gives you direct contact with the students, produces accurate knowledge of what is causing problems, and reveals why a particular paragraph, direction, or test item is problematic.

Take notes on teacher and student comments about the materials. After each session, have members of your observation team discuss their observations. Take notes on these debriefing sessions.

In the beginning, place no restrictions on how the teacher uses the material other than that they follow suggestions given in the Teacher's Guide. Note who does and does not read and easily follow the Guide's suggestions and correctly administers the teaching and testing. Try to understand why some get confused by your kit, or don't know how to manage the teaching and testing. Our own pilot test was very valuable in that it prepared us for seeing what had to be done to make the materials "mistake-proof" for teachers, and much easier to manage.

Ask students to keep all materials and tests they use in their folders, and to not take these folders home. Let teachers know that you will want to go through the folders when the course is completed.

APPENDIX

SUGGESTIONS OF ISSUES FOR PILOT TEST OBSERVERS

A. Do the teaching materials match student ability levels?

1. Is the reading level (vocabulary, sentence and paragraph complexity) appropriate? (Too high a level will discourage students, too easy may offend them.) Can most problems here be solved by defining more words and giving students repeated practice in their meanings?

2. Is the range and flexibility sufficient? Do the materials as a whole provide enough variety to meet the needs of both the fastest learners and the slowest learners?

3. Where and when do students appear to get confused or to most frequently need individualized help from the teacher? Which lessons are too compact or sparse and need to be broken down into more and easier steps? Which lessons are just too hard? Which directions are unclear? Is the material organized on the page in a confusing way? Are pictures, illustrations, graphs, diagrams, or their captions confusing?

4. Which elements or lessons seem to be the most and the least effective? Can the differences in effectiveness between these lessons be associated with differences in their teaching method, in how they present the content, or only with differences in the actual difficulty of their respective contents?

5. Is the learning sequence right, or should lessons be shuffled or reordered to put harder lessons nearer to

the end of the course? Are all lessons indispensible, or can one or more be dispensed with?

6. Are there enough review sections, and are they placed at the right junctures?

7. Which kinds of students and teachers do the best and the worst with the materials? Should you narrow down or expand the intended range of types of students for whom these materials will be appropriate?

8. For different types of students, what is the optimal proportion of narrative to illustrations? -to exercises? -to tests? -to page length? -to lesson length?

9. Which elements in the content seem most to need whole-class discussion and teacher demonstration? Which elements might be helped by teacher explanations using overhead projector transparancies? Which elements might be helped through group simulations of real-life situations requiring special materials such as fake money used in simulating transactions in our bank checking course? Which elements might be helped through uses of other technologies such as reel-to-reel films, film strips, ITV, audio recordings, etc.?

10. Do exercises and practices adequately prepare students for the tests? Do exercise and test items have the same structure, use the same vocabulary, cover the same content?

11. Do exercises cover all but only the content that students will be tested on? Are answers to all exercises adequately provided and explained in a near-by narrative?

12. Why do students give incorrect answers to exercise items? Are they skipping over key sections in the narrative? Are explanations in the narrative poorly formulated or unclear or too hard? Are answers in the narrative too far removed from the exercises (two pages back, two lessons back, etc.)? Are the directions or the structures of exercises confusing? Finally, are the exercise items themselves poorly formulated?

13. Are the tests adequate? Are they too long? Are they threatening? -if so, why? Are students failing because tests cover too much? Because directions are poor or test items are poorly formulated? Are students passing who have not really mastered the material? Because it is easy to cheat? Because the test covers only one part (the easiest part) of the lesson? Because, the way they're formulated, the test items answer themselves?

14. Do students need more aids (e.g., samples of items used in real-life situations, learning games, etc.)? Do they need more exercises and practices to prepare them for the mastery tests?

15. Are the principal learning materials (the "Main Text") just too difficult for a sizeable number of students? Do they need a simpler or more motivating "Main Text", and accordingly, an even easier and longer set of practices to use for relearning the content when they don't pass the mastery test? Can you develop a separate mastery learning system for those students?

16. How many forms, or equivalent but different versions, of each lesson's mastery test are needed for retesting non-masters or for ensuring that students can not copy each other's answers?

17. Do students desire (and do teachers need, and will they accept) student answer keys to exercise and/or mastery tests so that students can correct and score their own exercises and/or tests (and save the teacher a lot of time)?

B. Do the materials sufficiently motivate students?

1. If you observe students working in other materials prior to the introduction of your first draft, do they appear to work in yours with comparatively more/less interest, more/less tendency to be distracted, daydream, become discipline problems? Check your before-and-after comparisons with those of the teacher.

2. What spontaneous comments or other behavioral indicators of interest do students evince?

3. Do students appear to like or to not like working on their own at their own pace with only occasional individualized help from the teacher?

4. Ask students which pages, elements, lessons they like doing the most. Find out why they prefer these to others.

5. Which tests did they like doing the most or dislike the least? Why?

6. Do students prefer this or that kind of exercise or test item? Because it's easier or why?

7. Do students like frequent but brief tests, or would they prefer fewer but longer tests, or just one big test at the end?

8. Do they prefer pages with less narrative and more illustrations (e.g., cartoons), or pages with fewer illustrations and more narrative that better explains the content?

9. Do they appear to prefer some topics, contents, subjects to others and, if so, in which cases might this be more due to the method of presenting or teaching the content than to the content itself? (In any case, solicit student preferences to identify sections you will need to make more exciting, amusing, etc.).

10. Are students who fail mastery tests glad that they have a second chance to relearn and master the material? About how many relearning-retesting cycles can students of different types in different kinds of classrooms go through before they feel discouraged or humiliated and obviously need to be advanced to the next lesson whether they achieve mastery on the present lesson or not? For those students who do not pass the first time around, does ultimately passing at the true master's level sufficiently offset the feeling that they're getting behind or not as good as others that they face the next lesson more with eagerness than with trepedation or discouragement?

11. Does student interest seem to increase or wane during the course? As time goes on, do students increasingly try harder and more eagerly await mastering the next lesson and the next test? (Make sure that earlier tests are relatively easier than later tests to give students plenty of rewards at the outset and increase self-confidence.)

C. If individualized learning is a goal, how is it working?

Does the teacher encourage questions, teach small groups, look comfortable (not harried) and feel more at ease as time goes on? Do students constantly request explanations of the content or what to do next (because your materials do not adequately explain themselves)?

(In our pilot test of our own materials, we found that the less skilled the student, the more work that was required of the teacher and the more need there was for whole-class instruction.) If whole-class instruction is needed frequently, are there ways your materials can encourage the teacher to involve most students and prevent some students from tuning out?

Does the teacher use a variety of teaching strategies? If not, do things get monotonous? Can you add a greater variety to your materials to offset this?

D. Are the materials manageable?

1. If your materials either consist of several separate parts or are designed for students to move individually along different paths (sequences of lessons or units) through your materials, then:
    a. Can the teacher easily manipulate and orchestrate student use of the materials and keep track of all interactions between students and the materials?
    b. Are more directions to students needed, more directions to the teacher needed? Or do the materials and the system you've devised need to be streamlined and simplified?
    c. Do students frequently ask "What am I supposed to do now?"

d. Does the system begin working smoothly after some initial chaos? To make it work smoothly, has the teacher had to devise his/her own strategy for using the materials which strongly differs from your intended strategy and utterly destroys the value and validity of the system?

e. Ask teachers how they would use your materials if your observation team was not in the room. (Some teacher suggestions may point to ways to really improve your system. In any case, you must design the system, or present it, in a way that is truly acceptable to teachers since you will eventually not be able to control how they use it.)

f. Do students, or do teachers, move around the classroom more? Which appears to work better?

g. Do teachers who read your Teacher's Guide still seem confused about how to use your materials? Why do those who don't read the Teacher's Guide refuse to read it? (Would they have read it if you had made it more eye-catching, attention-grabbing, easier to consume quickly?)

2. At what class size does it become very difficult for teachers to properly manage the use of the materials? What class size appears to be ideal? Does this square with assumptions you have been making about your target students and the size of their classes? Can larger classes be effectively divided into small groups or pairs of students? Can teacher aides or students themselves assume some of the management responsibility.

3. Do teachers or students seem to ignore or overlook some part of your materials? Can you make that part more conspicuous, prominent, or central? Or is that part actually expendable?

4. What happens while student mastery tests are being corrected and scored by the teacher or other grader? Is there a sizable time-lag in this feedback loop? Do students use this time effectively? Is having students correct and score their own tests an alternative solution? Could they use the time skimming and preparing for the next lesson? Could they be helping other students?

5. Do some teachers manage better than others? Is this because of personal differences between these types of teachers or the types of classes they teach? Or are the more effective teachers using management techniques that can be taught and transferred to the less effective teachers? Can you incorporate the teaching of those techniques in the Teacher's Guide?

6. Do some elements or lessons seem to work better with one kind of classroom organization than with another? For instance, does abstract content seem to be best handled by whole-class lecturing led by the teacher? Which elements and lessons are handled well when students work on their own? Which work better in small groups? Which work better in role-play simulations? Which just have to be handled by aides or teachers working individually with the student?

E. Finally, does the teacher, and do the students, seem to GRASP the concept and process of Mastery Learning?

Do they understand that the tests are for determining whether students have mastered each lesson and are ready to move on, or for identifying deficiencies in their learning to focus on in their relearning of the material? Do they grasp that students compete with themselves for mastery, not with each other for grades? Do they grasp how to use the reteaching materials? Do they emphasize and appreciate the fact that non-masters always get another chance, a real chance with no "criminal record" held against them, until they ultimately become real masters? Do they grasp and practice individualized, self-paced, independent learning and self-instruction?

If they do not grasp these things, then your Teacher's Guide, and the students' materials as well, may need to be augmented with an introductory lesson that teaches these things to teachers and students before they start the course.

STAGE SIX: REVISE PILOT-TESTED FIRST DRAFT TESTS AND MATERIALS

1. Based on Stage Five's revision priorities and on available resources, assign revision tasks and staff and develop a schedule indicating by when revisions of tests, teaching materials, and the instructional management system are to be completed.

2. For all proposed solutions to problems uncovered in the pilot test, and especially solutions to instructional management problems, present the solution ideas to pilot test teachers and to members of the Mastery Learning Panel and solicit their judgements and preferences.

3. In regard to a major proposed solution for which there is not available supporting evidence about its worth, test it by comparing it to one or more alternatives. For instance, suppose the problem is that some pilot test teachers did not pick up and read the Teacher's Guide, and the proposed solution includes a particular way to make the cover of the Guide more eye-catching and specific ideas to make the first few pages of the Guide easier to read and more effective in presenting key concepts. Then a test of this proposal might consist in asking five teachers of target students who were not in the pilot test to compare a mock up of this proposed solution to teacher's guides in other published kits or series and also to mock ups of one or two alternative covers with ideas for revising the first few pages.

4. Before fully implementing major revision proposals that have been approved by the whole Project Team, cost them out to ensure that you can not only perform them and still stay within budget but can also still produce the final products at reasonable cost levels.

Revisions in our materials based on both our pilot test and our field test

1. A major problem in our pilot test concerned the manageability of our materials. Some portions of them, being difficult to manage, simply didn't get used by some teachers. We made the mistake of boxing lessons and tests loose in a file system. This meant that there was always a lot of loose paper around, and that teachers or students would have to be continually going to the box for materials. So after the pilot test, we went to a text (book) format except for tests. (After the field test, we decided to even include tests in books).

2. The pilot test showed that some teachers weren't grasping "mastery learning" and were using the materials to teach in their usual style. The best solution to their problem would've probably been some sort of in-service testing for teachers on mastery learning. But, since our goal is a published kit that needs no such supports, that wasn't an option. Decisions we did make: improve the teacher's guide to make it more readable and to emphasize the system more; place very clear instructions on what to do at every decision point in the materials (leaving nothing to the imagination); and add preliminary lessons in student materials on mastery learning.

3. The materials contained some features whose value needed to be analyzed. Analysis came from observation, interviews and teacher questionnaire responses. For example, we needed to know if the illustrations in the student texts were appropriate for this audience, and, if so, was the amount of illustration appropriate. Revisions were made according to feedback (in the case of illustrations, no significant changes turned out to be warranted).

4. There'd been a question on the number, placement, and appropriateness of the mastery tests in the student texts. The best data here came from observation and analysis of the tests students took. We found that there were a few too many tests, so the total number was reduced by combining several of them. Also, a number of students did very poorly on two particular tests. We realized that the instructional preparations for those tests was inadequate, and consequently made extensive revisions in the corresponding teaching materials. We decided that only minor revisions were required in those tests themselves.

5. Fairly extensive changes in vocabulary were made as a result of the pilot test. Basically, we'd aimed too high, and we'd assumed students would know many words which they didn't know. So some of the harder words were taken out and simpler words substituted. A glossary defining the remaining hard terms was added to the student texts for quick reference.

6. Some students required a lot of practice. Additional tests were later added and the Checking Illustrated text was expanded (from 70 to 96 pages) by adding even more explanation. Also, based on our pilot test observations, some students were learning slightly above the level of the materials. For that reason, and for reasons of economy, the Understanding Checking text was shortened a bit (some explanation was removed - the lesson structure was retained to make all three books have lesson-to-lesson correspondence to each other).

7. One lesson in the materials ("choosing an account and bank") turned out to be much harder for students than we'd expected. After the pilot test, we decided to move it from early in the materials and make it the last lesson.

8. Setting up the field test was easy. Teachers were eager to get free materials.

9. We determined from the pilot test that the materials were inappropriate for English-for-Speakers-of-Other-Languages students. We discussed whether or not we could make them appropriate, but dropped that idea as unworkable.

10. We had one pilot test class with 15 students. That was too many. The later field tests were done with smaller classes (except for one).

    (By the way, relevant to nothing. That large class, had three aides. Still, the teacher insisted on lecturing. She had to maintain her status. Had they broken up into groups, on the surface at least, she'd have had the same status as the aides.)

11. By continually reexamining our field notes, we were able to keep track of particular problems with items in the tests and materials. These problems were then corrected.

STAGES SEVEN - TEN: Field Test, Final Revisions, Production, and Publication and Marketing of the Materials

Our own development project included four additional stages which will not be described here:

Stage Seven: Field-Test of Revised Materials and Tests

Do this very expensive and complex stage only if there is a strong need for formal statistical evaluations of your mastery tests.

Assess the tests to determine their reliability and to perform item analysis on test items to identify those items for deletion that do not accurately sort students into master and non-master groups.

Compare types/categories of students to one another statistically to identify those types with whom each component of the kit is the most and the least effective. This enables you to identify which types of students may need extra help and support, and to identify which components of the kit are best suited for different types of students.

The field-test should be performed with a minimum of 200-300 students at ten or more sites who actually complete their learning in your materials. If your target population includes more than one major type or category of students, then multiply this sample size by the total number of target categories.

Stage Eight: Final Revisions Based on Field-Test Findings

Delete or upgrade faulty test items and unreliable tests. Add extra teaching aids or new materials for helping those types of students who were least able to succeed with the materials.

Stage Nine: Production

Do this only if you are going to publish and market your materials. Edit, mark-up, type-set, format, print, and package the materials for formal publication.

Stage Ten: Publish and Market the Produced Materials

Establish the price of the publication. Finalize the packaging strategy. Identify, and obtain mailing address labels for, targeted groups of potential buyers of the package. Produce and distribute one or more flyers to advertize the package: present or demonstrate the package at conventions, conferences, book fairs, etc.

These last four stages go beyond the scope of this Guide because they have nothing especially to do with mastery learning per se or with the development of educational materials per se. They also involve technical matters that require professional expert advice, aid, and leadership that may be beyond your organization's capabilities. For Stages Seven and Eight, outside professional evaluators should be contracted to carry out the field test. Steps Nine and Ten should be performed by a publisher of educational materials.